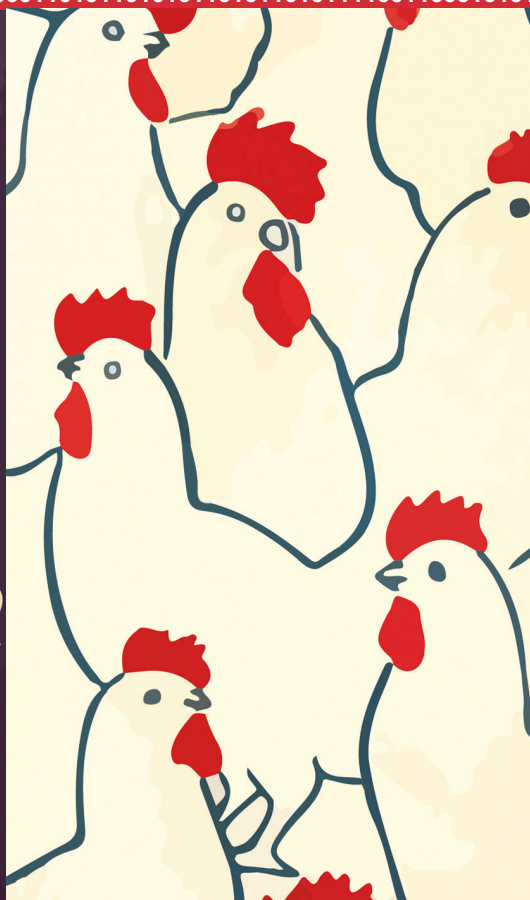


# ★ ATLAS

## of livestock transitions in Vietnam 1986-2016



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# Title: Atlas of Livestock Transitions in Vietnam

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## Citation:

Cesaro J.-D., Duteurtre G., Nguyen Mai Huong (Eds.) (2019) *Atlas of Livestock Transitions in Vietnam: 1986-2016*, IPSARD, CIRAD, Montpellier, Hanoi, 64 p.

## Published by:

Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD)  
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the French Agricultural Research Centre for International Development (CIRAD)

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# **Atlas of Livestock Transitions in Vietnam**

## **1986-2016**

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**Edited by:**  
**J.-D. Cesaro, G. Duteurtre, Nguyen Mai Huong**

**Atlas produced through the Revalter project**



**Revalter project conducted through the Malica platform  
in partnership (dP) framework**



# Foreword

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## Dr. Hoang Vu Quang

**Deputy director  
IPSARD**

Livestock production is playing an increasingly important role in agricultural development in Vietnam. Its contribution to farmers' livelihoods and income is growing, and accounts for over 1/3 of agricultural GDP. The livestock development strategy adopted in 2008, and the restructuring strategy for the sustainable development of the sector implemented since 2014, have engaged the livestock sector in a process of rapid transition. More recently, the 2018 Law on Animal Husbandry put into effect the country's ambition to pursue the development of its livestock industry within a context of an increasingly integrated world economy, scientific and technological developments, industrialization, rapid urbanization, and ongoing climate change.

The livestock development strategy aims to transform the livestock production sector into a modern industry that meets international standards regarding health safety, production quality, animal welfare and environmental management. This effort requires private sector investment, the backing of different levels of government and support from research.

As a "think tank" under the Ministry of Agriculture and Rural Development (MARD), IPSARD is involved in diverse research and advisory activities involving the livestock sector, such as monitoring the structural transformation of farms, supporting organizational innovation in value chains and developing national sector development policies. Thanks to its range of social science and agriculture science capabilities, IPSARD has been at the forefront of scientific research since it was first established. IPSARD has worked with CIRAD for many years through joint French-Vietnamese projects. The Revalter project, which contributed significantly to the publication of this Atlas, is among these. The outputs of this project demonstrate that the agricultural censuses that have been carried out since 1994 are a source of very useful data for policy making. The project's outputs have furthermore helped to guide various decisions regarding the industrialization of livestock production since 2016. We hope that this Atlas shall provide readers useful information for working and investing in a sustainable manner in Vietnam's livestock sector.

## Dr. Philippe Girard

**Regional Director for Continental Southeast Asia  
CIRAD**

The Atlas of Livestock Transitions in Vietnam 1986-2016 is one of the most significant outputs of the Revalter project. It is the fruit of long years of French-Vietnamese cooperation in the field of rural and agricultural development. Since 1994, CIRAD and other French research institutes have conducted research in partnership with Vietnam. The first cooperation programs focusing on livestock issues were conducted within the Red River Program and under the Mountain Farming System Project (known under the French acronym, SAM). The former had a positive impact on small pig farmers around Hanoi and in the regions of Nam Định Hải Dương, Hải Dương and Hải Phòng. The latter focused on proposing solutions to sustainably intensify mixed crop-livestock systems in the north of the country. CIRAD also participated in relaunching dairy production in Mộc Châu through fodder crop trials.

These projects produced outputs that led to technical innovations which continue to have a sizable impact today. CIRAD furthermore worked with the NIAS under the E3P project on the management of pig effluents between 2004 and 2006. These numerous collaborative efforts were based on the establishment in 2002 of a partnership framework called the Intensification of Livestock Systems Research Cluster (PRISE). In addition to CIRAD, PRISE included NIAS, NIVR, VNUA, RUDEC and IPSARD. This partnership mechanism gave rise to numerous livestock development projects such as REVASIA, the precursor of GREASE, on the management of emerging disease risks in Southeast Asia. Many other livestock production sector projects have contributed to the dynamics of the MALICA consortium, which brings together several research institutes, including IPSARD and CIRAD, around food supplies for cities in Southeast Asia.

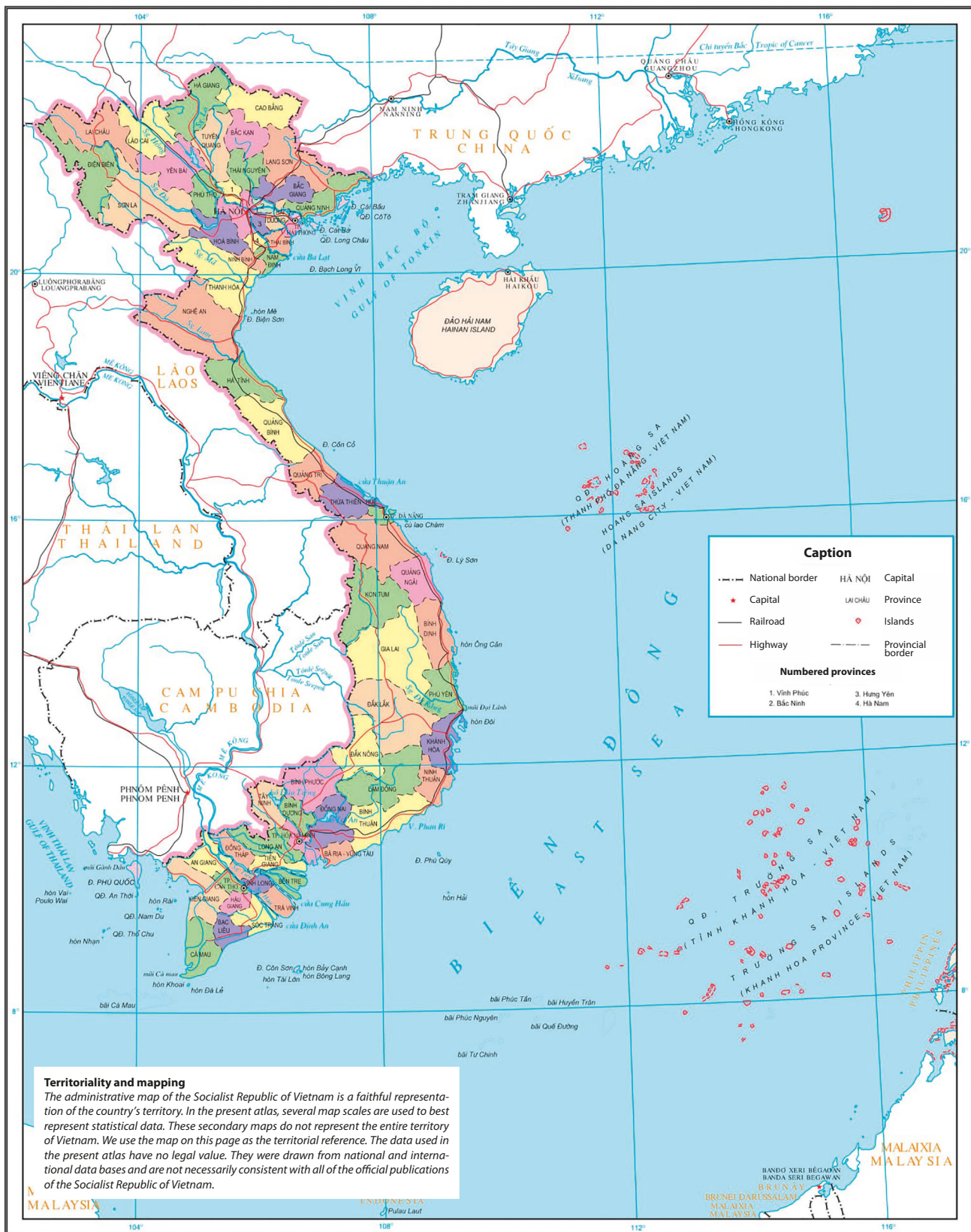
The Revalter research project, implemented with financial support from the French National Research Agency (ANR), is part of this long cooperative relationship between CIRAD and Vietnamese agricultural research institutions. This four-year project enabled the production of scientific knowledge on the transformation of the livestock sector and the development of public policy recommendations. The Atlas is one of the project's emblematic outputs. It is an innovative way to communicate scientific results to a broad audience to deepen understanding of the current dynamics of the pig and dairy sectors in Vietnam.

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# Administrative map of the Socialist Republic of Vietnam



## Territoriality and mapping

The administrative map of the Socialist Republic of Vietnam is a faithful representation of the country's territory. In the present atlas, several map scales are used to best represent statistical data. These secondary maps do not represent the entire territory of Vietnam. We use the map on this page as the territorial reference. The data used in the present atlas have no legal value. They were drawn from national and international data bases and are not necessarily consistent with all of the official publications of the Socialist Republic of Vietnam.

Scale 1: 9 000 000

Bản đồ này được cung cấp để đăng tải trên Cổng thông tin điện tử và các trang thông tin điện tử của Cơ quan nhà nước và các tổ chức, cá nhân;



# Introduction

## The livestock revolution on the eve of 2020

In emerging and developing countries, the livestock sector is booming. While the production and consumption of animal products are stagnating in the developed world, the livestock sector is experiencing sustained growth in the Global South. In Southeast Asia, the FAO estimates that meat production has grown by 4.6% per year over the past 10 years. Milk production has jumped by 5.8% per year. The driving factors are population growth and higher living standards, which are fuelling an increasing demand for meat and dairy products.

This rapid rise in consumption does not rely only on cheap imports from industrialized countries. Some countries, such as Vietnam, have the capacity to produce for themselves, and are counting on the development of domestic production and the restructuring of livestock farming. A genuine “livestock revolution” is underway, similar to the various agricultural revolutions that have taken place since the invention of the plough.

## Vietnam in the livestock revolution

Livestock farming in Vietnam is experiencing this revolution. The country has never before seen such a rapid and radical transformation of its livestock production systems. Between 2000 and 2015, the number of poultry doubled. The pig herd increased from 21 to 28 million heads. And the number of dairy cows increased sevenfold. In the next few years, the country may even become a regional exporter of meat, eggs and milk, with the ASEAN market, and in particular the Chinese market, providing interesting opportunities for the Vietnamese livestock sector.

The emergence of intensive commercial livestock production in Vietnam has been strongly encouraged by recent developments in economic policy. Following the end of collectivization in the early 1980s, Vietnam initiated a series of reforms (*Đổi mới*) in 1986 aiming to promote a socially oriented free-market economy by offering a more flexible framework for private initiatives. By liberalizing the animal production industry, Vietnam entered a restructuring phase that affected the livestock sector in particular. For example, the average size of pig and poultry farms increased substantially while the number of producers declined. Smallholder production gradually was transformed, and new types of industrial farms emerged.

## Intensification of the livestock sector

The restructuring of the sector hinged on a more intensive use of production factors, meaning a heavy reliance on financial capital, inputs and modern technologies. Investments in animal genetics and livestock buildings, the development of selected fodder crops, and the importation of know-how, animal feed and veterinary products enabled rapid improvements in farm technical performances (breeding productivity, average weight gain per feed unit, and quantity of milk per cow). This intensification led to an increase in the productivity of land (characteristic of “intensified” farming systems) and labor (a source of enhanced farm incomes). The in-depth transformation of livestock production was enabled by support from government agricultural production services, which facilitated improvements in farmer know-how, the dissemination of technologies and access to credit.

Intensification also was based on the emergence of industries and commercial enterprises up and down production chains, which enabled the dissemination of inputs and technical models, as well as the development of market opportunities.

## The sustainability of livestock systems in question

Such a rapid transformation of production systems has involved periods of crisis and adjustment. But above all, this transformation has led to a profound change in the relationship between livestock farming and the environment. Animal production units gradually have become disconnected from crop farming, leading to specialized livestock systems. Thus while prior to the 2000s only 10% of feed requirements were met by industrial feed (the remainder produced on-farm), today imported products account for nearly 66% of the feed used on livestock holdings. This “decoupling” of crop and livestock farming has had far-reaching implications. It has led the country to become increasingly dependent on imported raw materials for livestock feed, and to a growing concentration of livestock effluents around intensive farms. New questions have arisen. Is this new situation endangering local ecosystems? How can smallholder farming cope with the emergence of giant farms with several thousand animals? Lastly, how can livestock production systems be relocated so that they are better integrated into their ecosystems?

## The spatial rationales of the livestock sector

In the midst of these upheavals, space is a fundamental issue. These intensification and industrialization processes are not occurring in a uniform manner across the country. Beyond a spatial concentration of production, one may observe regional specializations oriented around certain production models or livestock activities.

This dynamic transformation process of the livestock sector is particularly interesting because it combines strong State commitment to concentrating production capacity with the intent of private actors to continue operating in an increasingly competitive economy. Since the whole nation is facing land scarcity, space is decisive for development, which raises questions regarding the limits of the “livestock revolution” currently underway.

## An atlas to describe the transformations in livestock production

The creation of a livestock atlas is a response to these needs. By using different sources of information, including four Vietnamese agriculture censuses (1994, 2001, 2006 and 2011), the present atlas aims to quantitatively describe the process transforming the livestock sector by highlighting both the spatial dimension of this modernization dynamic and its temporal evolution over the past 30 years. Thanks to the mapping and spatial analysis methods used, readers can grasp how sites and infrastructure such as cities, highways, livestock feed factories and port areas have influenced the transformation of livestock production.

Published in a format that is easy to consult, this atlas is meant to be a simple, educational tool intended for anyone interested in the conditions of sustainable agricultural development in countries of the Global South.

*Family farms in Phu Tho (pig) and Ba Vi (cow)*



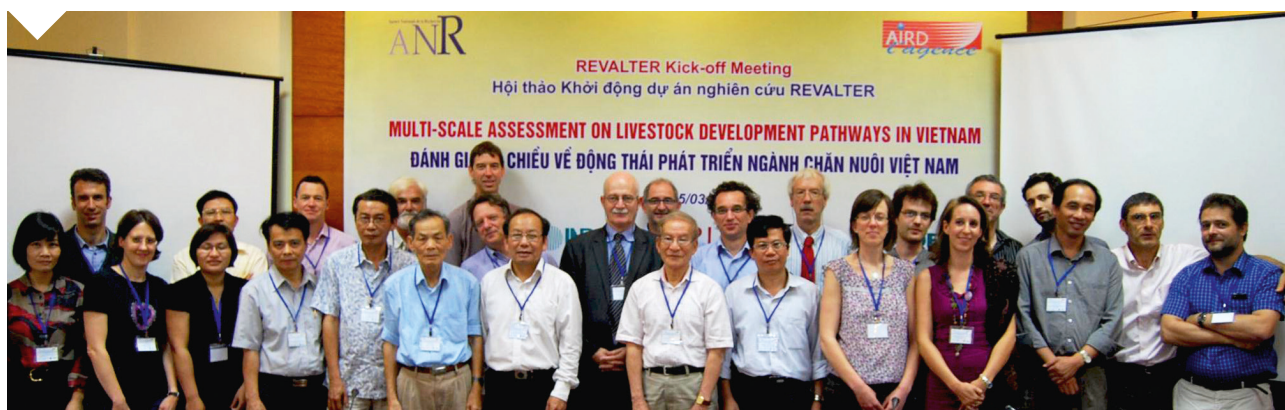


# Livestock transitions in Vietnam

## The Revalter project

In response to the upheavals underway in the Vietnamese livestock sector, the Revalter project aimed to study the transitions in process and assess their sustainability. The name of the project is drawn from the concepts of “livestock REvolution” and “sustainable ALTErNatives”. One of the project’s goals was to identify alternative pathways in order to propose sustainable solutions to policy makers to orient the future direction of the sector. The project thus aimed to promote a fresh perspective on the development of livestock production in Vietnam, notably by re-examining complementarities between crop and livestock production. Funded by the Agrobiosphère program managed by the French National Research Agency (ANR), it was implemented from 2013 to 2016. The project drew from available national data as well as field studies that enabled a better understanding of past and present transformations.

*Launch of the Revalter project in 2013 (Hanoi)*



© CIRAD (2013)

In the 2000s, CASRAD and RUDEC, both recently established, played an important role alongside NIAS in the pursuit of this Franco-Vietnamese collaboration on livestock production. Thanks to the constitution of a consortium on the rational intensification of livestock farming systems (the PRISE research platform), new projects were launched to support livestock value chains and the sustainable intensification of dairy systems. The Revalter project is a continuation of these partnerships that are enabling strengthened collaboration between research teams and the development of new research methods on sustainable development themes.

*Livestock feed factory under construction in Đồng Nai*



© J.-D. Cesaro - CIRAD (2015)

## A forty-year partnership between France and Vietnam focused on livestock production

The institutional context in which the Revalter project was implemented is part of a long partnership between Vietnam and France. Vietnamese research institutions invited INRA and CIRAD to participate in agriculture development research efforts.

Beginning in 1983, an INRA office was set up in Hồ Chí Minh City to support the livestock institute of South Vietnam. Later, under the Red River Program implemented in partnership with GRET in the 1990s, the Vietnamese Agricultural Sciences Institute (VASI) worked on numerous occasions with French research groups, particularly on livestock issues.

## A multi-disciplinary approach to change

The Revalter team investigated changes affecting the sustainability of Vietnamese livestock systems, and aimed to understand the institutional, socio-economic and agro-ecological mechanisms underlying livestock farming transitions. The innovative feature of this project was the development of a multi-disciplinary approach. Three levels of analysis were implemented: farm, territory, and value chain. These three levels were part of a more comprehensive framework used to analyze change pathways that emphasized the study of political and institutional dimensions.

*Contract livestock production in Đồng Nai*



© J.-D. Cesaro - CIRAD (2014)



## From the livestock farming system to the territory

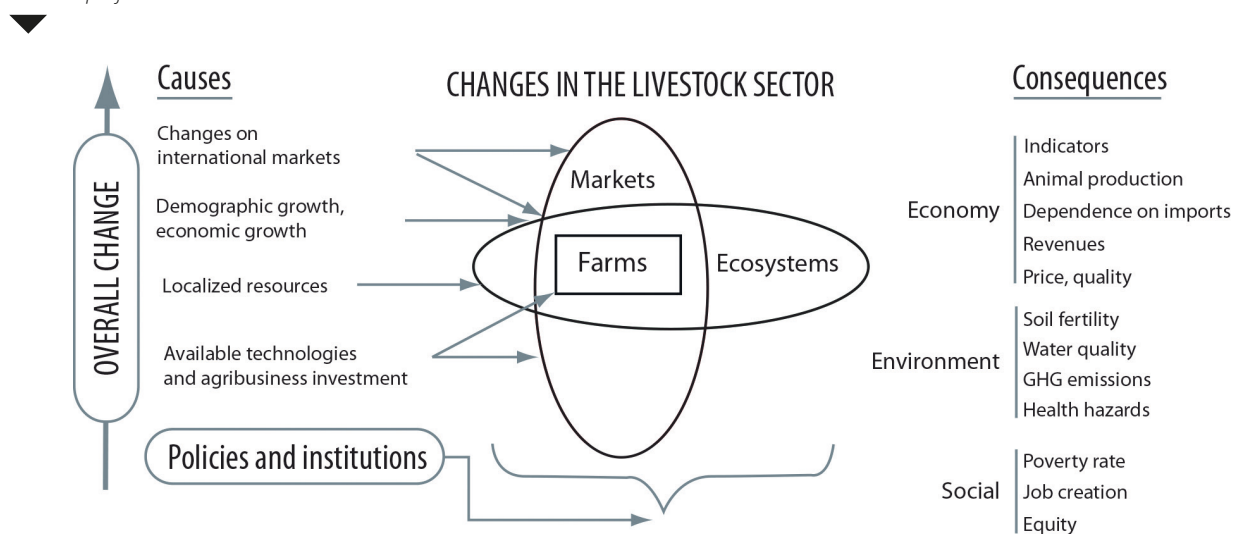
To better understand the position of livestock activities within the organization of a farm, the livestock system is approached as a sub-component of the production system. At a higher level, the farm is embedded in a market (the value chain) and a space managed by a community (the territory). These two dimensions (market and territory) intersect at the farm level. The livestock sector is thus considered within its relationships to its environment. The analysis of livestock farming activities within value chains and territories renders it possible to identify drivers of change, understand agricultural dynamics, and assess the impact of change pathways on sustainable development.

Cooperative pig farm in 1986



© G. Trébuil - CIRAD (1986)

Revalter project model



## Understanding farm trajectories

Due to these changes, some farms will encounter an economic environment favorable to their growth, while others will stagnate, shrink or even disappear. These different farm trajectories together lead to a restructuration of livestock systems and a reorganization of value chains.

## Modelling the transition pathways

The innovative feature of the Revalter project was to characterize the spatial dynamics of the relocation of animal production at different scales. To what extent is the livestock sector in Vietnam following, entirely or partially, the development pathway of agriculture sectors in industrialized countries? Is it in the process of inventing its own change pathway? How can the multiplicity of pathways that exist in time and space be captured? How can scenarios of the sector's future development be proposed to institutional actors? The results of the Revalter project presented in this atlas answer these questions to a certain extent.

The project's model is based on an economic area with a city-market that polarizes a production space. Depending on the overall economic period, which is derived from the country's development cycles, livestock production takes place more or less close to markets or resources. Two dynamics then appear: a concentration of production around markets, then, in contrast, a redistribution of resources generating clusters with animal density peaks.

Family pig farm in 2006



© V. Porphyre - CIRAD (2006)

# The data used in the Atlas of Livestock Transitions in Vietnam

## Annual statistics produced by the GSO

The General Statistics Office (GSO) is in charge of the production and dissemination of socio-economic statistics under the authority of the Ministry of Planning and Investment (MPI). Each year, it publishes “open access” statistics that can be mapped, most often at the scale of provinces. These statistics cover all 63 provinces (*tỉnh*) which constitute the country’s main political and administrative units. Among these data, agricultural statistics occupy an important position. They are available for the period 1995 to the present. They cover diverse topics, including production (in terms of value and tonnage), number of livestock, areas cultivated, yields, number of commercial farms (*trang trại*) and land use. The number of livestock corresponds to the number of animals present on farms on October 1st of the year, considered for buffaloes, cows, pigs and poultry. In each province, a GSO office publishes an annual directory listing the official data for each district. In total, there are just over 700 districts (*huyện*) in Vietnam. These provincial data records are only accessible on paper at the provincial level, and only cover the past three to four years. Due to a lack of centralized access to district data, they are difficult to use.

## Agriculture and rural censuses

Since 1994, the GSO has carried out a comprehensive agriculture and rural census (ARC) every five years with support from the FAO. These censuses took place in: 1994, 2001, 2006, 2011 and 2016. The 1994 agriculture and rural census is only available in a two-volume paper document located in the National Library of Vietnam. Unfortunately, this census has never been converted into digital form. The data from the most recent 2016 agriculture census also were not yet available when the atlas was written. Consequently, these data are not presented here. In the data bases produced from the 2001, 2006 and 2011 censuses, the scale of observation was the household level. Rural households (*hộ nông thôn*) are defined by their place of residence in a rural commune (*xã nông thôn*) and may or may not be engaged in agriculture. In contrast, farming households residing in urban communes (*hộ nông lâm nghiệp và thủy sản ở thành thị*) are included in the censuses.

## Census: data per household

For each household, the censuses provide data on the basic structure of the farm: number of household members, ages, economic activities, agricultural land, types of crops, number of animals and agriculture equipment.

## More precise agriculture data in 2011

Since 2011, the census has separated family farms from commercial farms (*trang trại*), which are specific agricultural holdings identified as such by local authorities based on high revenues. The census also includes agricultural cooperatives (*hợp tác xã*) and agricultural companies (*doanh nghiệp*), listed in the commercial register. In total, the 2011 agriculture and rural census counted over 16.1 million households, including 10.3 million farming households, 20,028 commercial farms, 6,302 cooperatives, and 2,536 companies. The distinction between these four types of production units is critical for understanding the reorganization underway in the Vietnamese countryside. To obtain data on agricultural areas and livestock head counts by administrative unit, we had to combine the information regrouping these four types of production units.

## The Livestock Atlas (1986-2016)

The present atlas thus used data from the censuses conducted in 1994, 2001, 2006 and 2011, which rendered it possible to characterize the evolution of livestock systems since *Đổi mới*. Access to these data bases was made possible thanks to the support of World Agricultural Watch (WAW) based in FAO’s headquarters in Rome and the FAO office in Hanoi. These data include the description of farm holdings present in 9,071 rural and urban communes (*xã*) out of a total of 11,112 communes across the country.

## Localized data

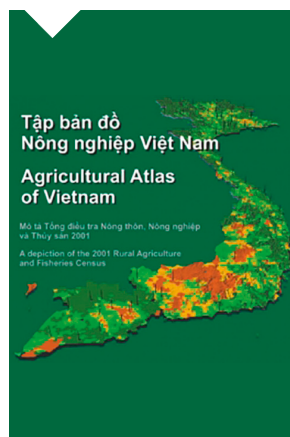
To use these censuses, it was necessary to harmonize the administrative boundaries between the years 2001 and 2011 as the administrative borders of provinces, districts and communes had changed between these two dates. Lastly, to complement the national statistical data and the agriculture census data, in some cases we used satellite photos, survey data and georeferenced field observations.

The 2016 agriculture census as presented by the official press



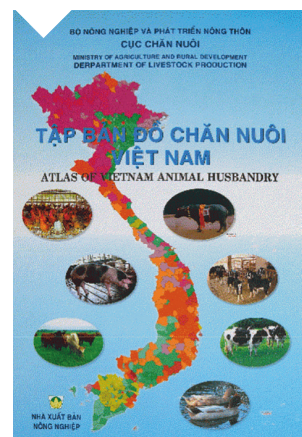
© GSO (2016)

2001 agricultural atlas



© PPL-FAO/GSO (2007)

2007 livestock atlas



© DLP (2008)



# Chapter 1

## The emergence of a new Vietnam

*G. Duteurtre, Dao The Anh, Hoang Vu Quang, C. Culas, E. Pannier*



© J.-D. Cesaro (2013)

*"Love'in Farm, 100% fresh milk"*  
*An advertisement for milk and the modern urban landscape in Hanoi*

# Vietnam, a country in transition

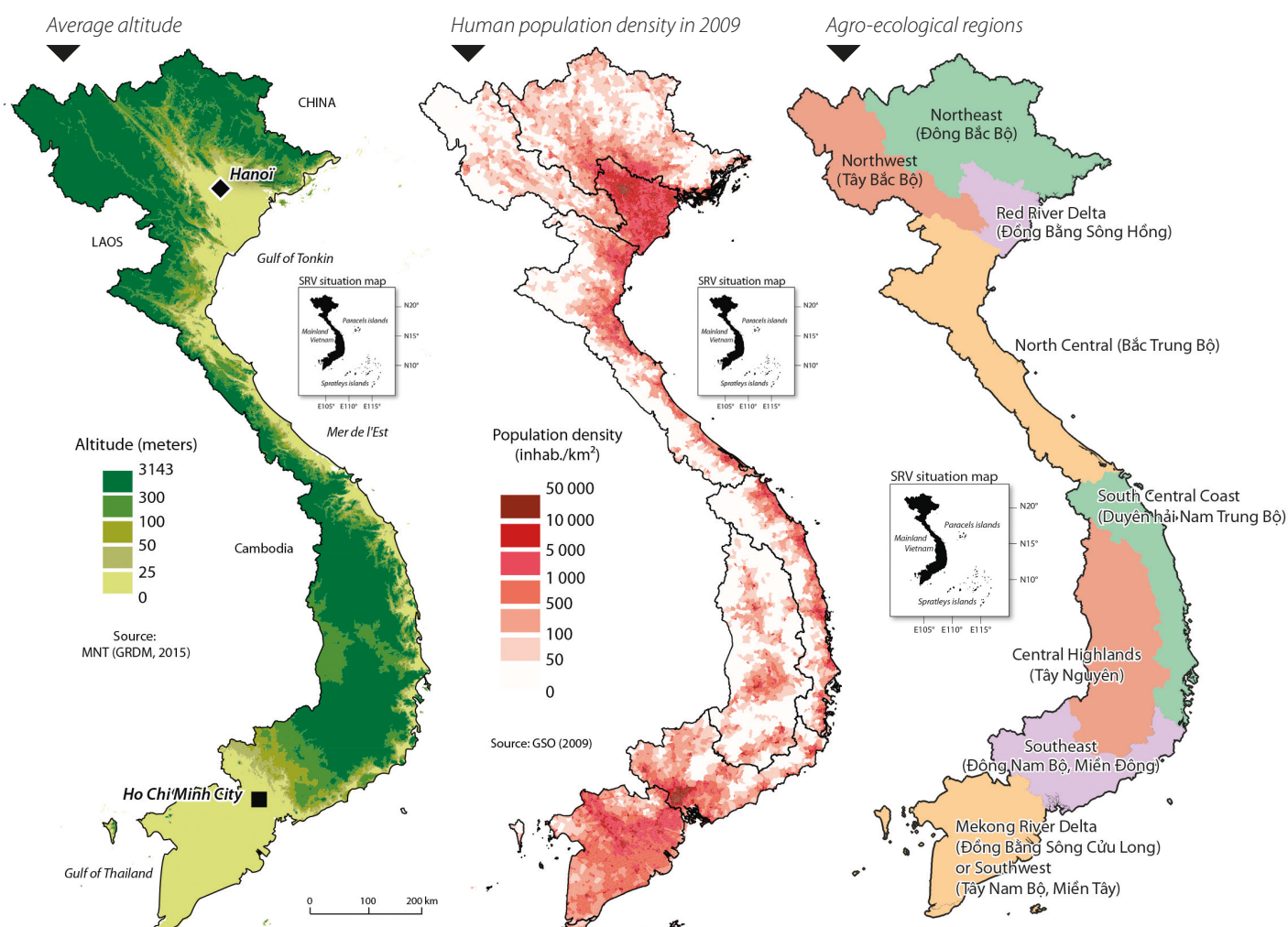
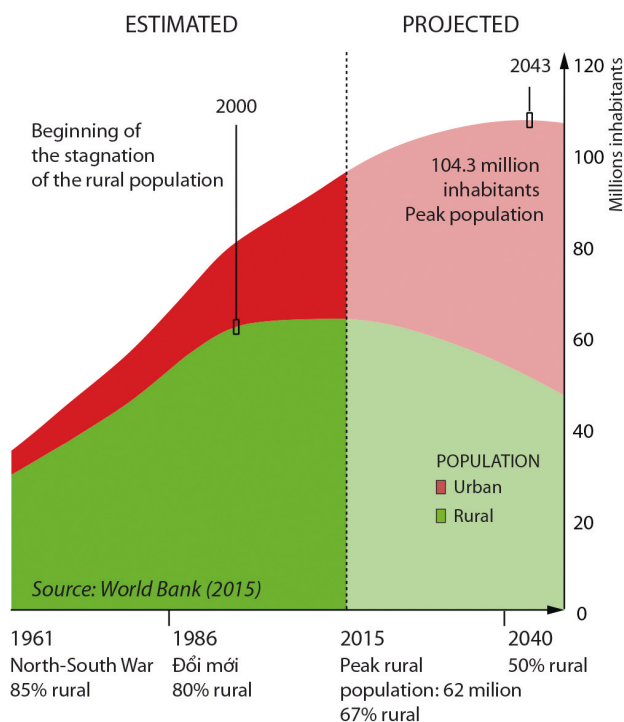
## A Southeast Asian country

Vietnam is a country located in Southeast Asia. Covering an area of 330,900 km<sup>2</sup>, the country is composed of two large flood plains, with the Red River Delta in the north and the Mekong Delta in the south. These two deltas are separated by a coastal strip, approximately 2,000 km long, and the Annamite mountain range, which stretches from the northwest region to the centre of the country. The tropical monsoon climate has two main seasonal regimes: in the south, a dry season alternates with a wet season, in the north, there are four seasons.

## Rural areas, density and growing urbanization

Vietnam is known to have among the highest human population densities in the world. At the country level, the human population density is 272 habitants/km<sup>2</sup> (roughly the same as Germany), but it is unequally distributed. Half of the population is concentrated in the two deltas, which cover less than a third of the territory. Rural communes around Hanoi have over 5,000 habitants/km<sup>2</sup>. Population growth is dynamic. In 1961, the country had 35 million inhabitants, 95% of whom lived in rural areas. In 2017, the population of Vietnam was around 90 million inhabitants, with two-thirds in rural areas. Since 2015, the rural population has reached a peak of 62 million inhabitants. According to FAO projections, about 50% of the population will be urban in 2050. This situation suggests profound changes in terms of urban-rural relations, employment and the structure of the economy.

Evolution of the population between 1961 and 2050





## Diverse landscapes

Vietnamese landscapes range along a gradient from coastal plains to mountain areas:

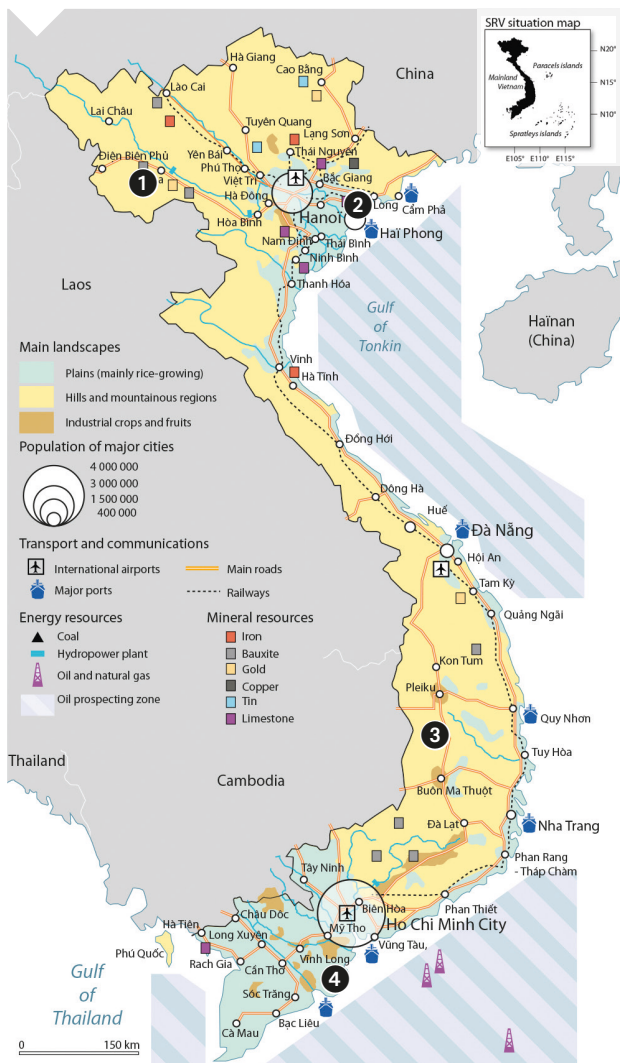
### Coastal plains

These territories are organized around water management. High human population densities have woven the space into a closely interconnected urban fabric composed of towns, villages organized around particular trades, and industrial zones. Housing is clustered together to protect agricultural land. The dominant ethnic group in these regions are the Kinh. The cities are often placed at the confluence of major waterways. These cities are at the centre of a vast regional development process linked to commercial ports such as Hải Phòng and Vũng Tàu.

### Mountain regions

The mountains are much less integrated into the development process. The population is made up of several ethnic groups. An economy dominated by subsistence farming and forestry exists alongside commercial agriculture and non-agricultural activities. In the center, cash crops such as coffee and rubber were first planted by colonial farmers, then developed by state farms and finally left to local communities to manage. The mountains have been particularly hard hit by deforestation and erosion. Some valleys are disappearing under hydroelectric and mining activities. A weak transportation network remains an obstacle to development in these areas.

### Economic development of the territory



Sources : Vu Tu Lap et Christian Taillard, Atlas du Vietnam, GIP Reclus et la documentation française, Paris, 1994  
Hughes Tertrais, Jean-Claude Pomonti, Vietnam, Communistes et dragons, le monde éditions, Paris, 1994.

### Northern mountain region



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### Red River Delta



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### Central highlands region



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### Mekong Delta



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# Economic liberalization and development

## The 1986 economic reforms

In December 1986, the State of Vietnam decided to move from a centrally planned and collectivist economy to a socially oriented market economy. After several sweeping economic and institutional reforms (*Đổi mới*), the United States decided to support Vietnam's efforts by ending the economic embargo that had been in force since the war. Vietnam expanded its trade with the rest of the world starting in 1993. According to the World Bank, the GDP per capita was then under US\$200 a year. In 2016, it was estimated to be US\$2,200 a year.

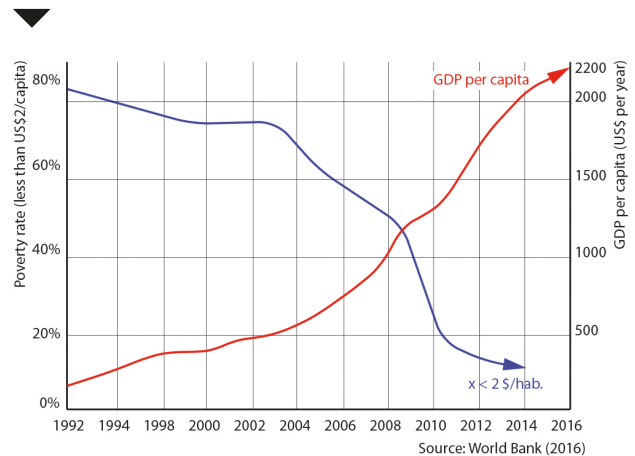
## Poverty reduction

The primary effect of this economic liberalization was the rapid reduction of poverty in Vietnam. Between 1995 and 2008, the share of the population living on less than US\$2 a day declined from 85% to 42%. At the same time, the number of Vietnamese living on less than US\$1 a day dropped from 60% to less than 10%. Poverty remains pervasive in the mountain areas, notably in the north of the country, but also is concentrated noticeably in the Red River Delta.

## Reduction of agricultural employment

This reduction in poverty is linked to a decline in agricultural employment. Between 2001 and 2011, the number of households active in the agriculture sector passed from 21.3 million people to slightly less than 19 million. During the same period, the rate of principle employment in agriculture fell from 80 to 50%. The diversification of rural household income sources was marked by an increase in non-agriculture income. However, according to the GSO, the number of rural households with agricultural land in contrast increased from 9.4 million in 1994 to nearly 12 million in 2011. While the importance of the agriculture sector in employment shrank, that of agricultural land was reinforced. This observation indicates that the relationship between town and country, like the economy, is becoming more complex.

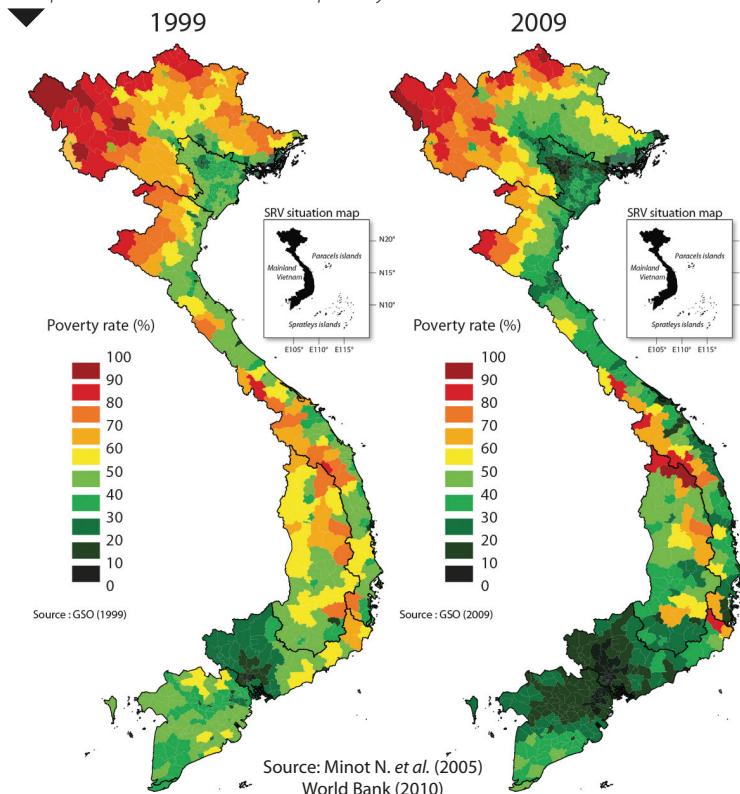
Evolution of the poverty rate and GDP/capita since 1992



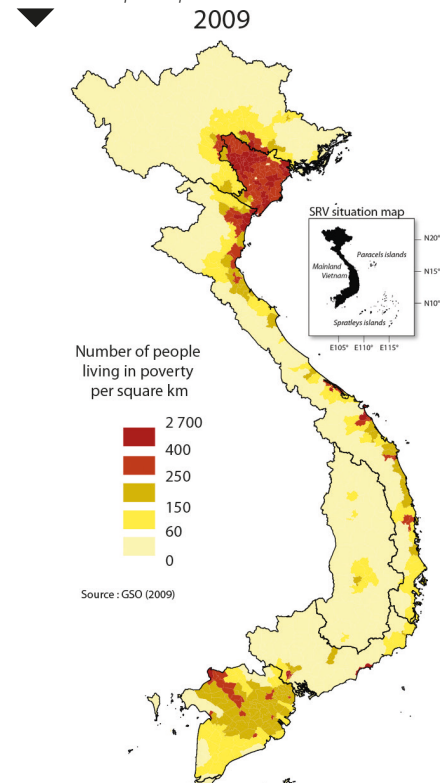
Propaganda poster on the relationship between town and country



Comparison of the 1999 and 2009 poverty rates



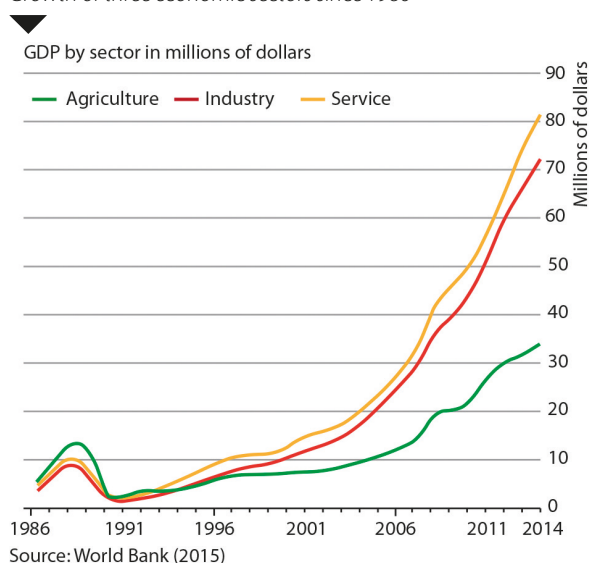
Number of "poor" per km<sup>2</sup> in 2009



## Agriculture in relation to other economic sectors

In 1995, the agriculture sector was worth US\$4 billion and accounted for 35% of the nation's wealth. In 2015, agriculture GDP surpassed US\$34 billion but accounted for only 17% of national GDP. Amid booming secondary and tertiary sectors, the increased value of agriculture has not enabled the sector to maintain its role in the economy. Vietnam is among the countries known as "Asian Tigers", meaning economies involved in the second wave of industrialization in Asia. These new exporting countries (NEPs) have witnessed a flood of direct foreign investment (DFI) into export sectors such as textiles and information technology. This situation explains why young people are interested in migrating to towns and industrial areas. However, at the national level, 50% of the population continue to depend on economic resources derived from agriculture.

Growth of three economic sectors since 1986



## Industry in need of a workforce

Vietnamese industry relies on a young and moderately qualified workforce. Despite strong state controls on migration, rural youth between the ages of 20 and 30 are leaving the countryside for industrial urban areas and foreign worksites. The wealthiest leave for Japan or the Arabian Peninsula, while the others work in factories on the outskirts of large cities and the main provincial towns. The men and women remaining in the countryside work in construction and rural industry sectors, or become agricultural workers on large farms.

Hanoi: a town growing into a metropolis



## ASEAN, OCM and TPP

A maritime country situated in the middle of important trade routes, Vietnam is positioning itself as a hub able to compete with the largest economies in the region. On 28 July 1995, Vietnam joined ASEAN as a transition economy. In 20 years, the country has aligned its economy with that of the economic community. In 2015, it joined ASEAN's free-trade market, helping the emergence of a regional economic community (AEC). In 2008, Vietnam joined the World Trade Organization (WTO) as a non-market economy. WTO considered the country's domestic market to still be overly closed. The Vietnam government then became pro-market and committed itself to setting up free-trade treaties with the United States and European Union.

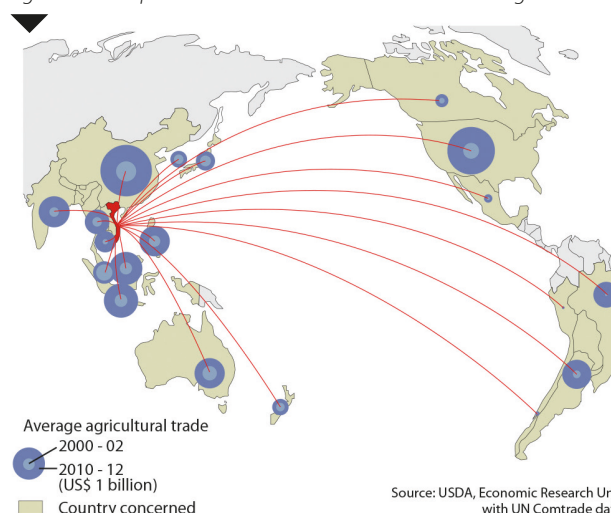
Date of entry into ASEAN of various member countries



## Rising exports

Between 1995 and 2012, exports from Vietnam increased in value from US\$5 billion to over US\$112 billion. This transition was made possible by the increasing sophistication of the country's industrial sector. The export of agricultural products from Vietnam also markedly increased. In 1995, Vietnam exported agricultural products worth US\$1.6 billion, notably rice and fish. In 2011, agricultural exports exceeded US\$10 billion. Exports of rice and aquaculture products increased, but other products such as coffee, cashew nuts, pepper, rubber and tea also assumed an important place in foreign trade. The agriculture trade balance remains positive.

Agricultural exports from Vietnam towards the Pacific region





# Evolution of food consumption

## Food consumption on the rise

Thanks to the country's expanding economy, living standards are improving. The consumption of food products is one indicator of this improvement. In the 1990s, daily food consumption was 2,000 kilocalories per person, with the daily calorie requirements of an adult varying between 1,900 and 2,100 kilocalories. In 2011, food consumption exceeded 2,700 kilocalories. Plant-based kilocalories increased from 1,800 to 2,200. One Vietnamese eats approximately 150 kg of rice per year, the equivalent of 1,400 kilocalories from rice per day. Dietary intake has diversified with the inclusion of fruits and vegetables.

## Consumption of animal products increasing sharply

The share of animal products in consumption is outpacing other foodstuffs. They provided 170 kilocalories per day in 1990 compared to 600 kilocalories in 2011. Meat accounts for 90% of animal-based food consumed in Vietnam. In the early 2000s, there was a sharp difference in consumption patterns between urban and rural areas. This difference has since diminished. In contrast, the gap between rich and poor in terms of the consumption of animal products remains wide.

## Demographic effect on consumption

Between 1986 and 2011, the population grew from 60 million to nearly 90 million inhabitants. At the same time, per capita meat consumption increased from 14 to 57 kg. Thus, while the size of the population increased by 50%, meat consumption grew by 300%. The effect of changing dietary habits has been amplified by the demographic factor. In 1986, 900,000 tons of meat were consumed compared to over 5 million in 2011. At 3.1 million tons, pork is the primary meat consumed. Chicken follows at 1.4 billion tons. The consumption of beef (cattle and buffalo) remains minor at 600,000 tons.

## The rise in meat consumption

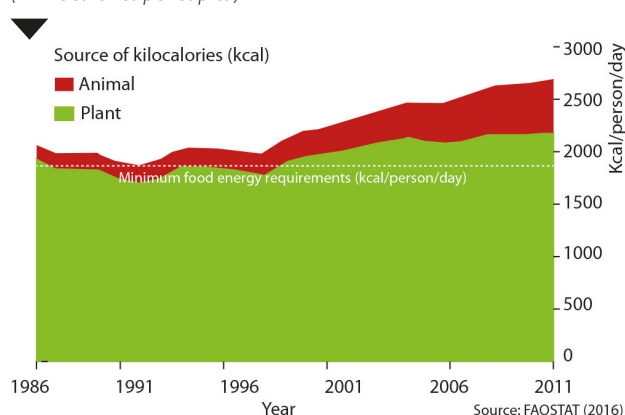
Pork is the main source of calories and animal protein. However, since 2006, the consumption of chicken has been growing, notably because of the increase in meat imports linked to Vietnam's entry into the WTO.

*A meal in the countryside: heavy on meat*

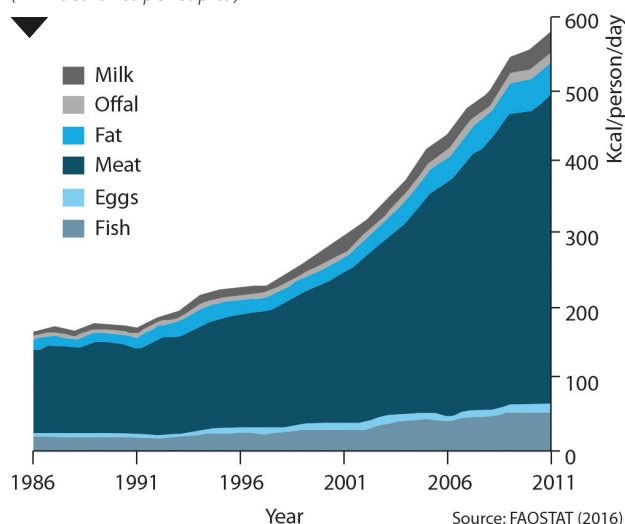


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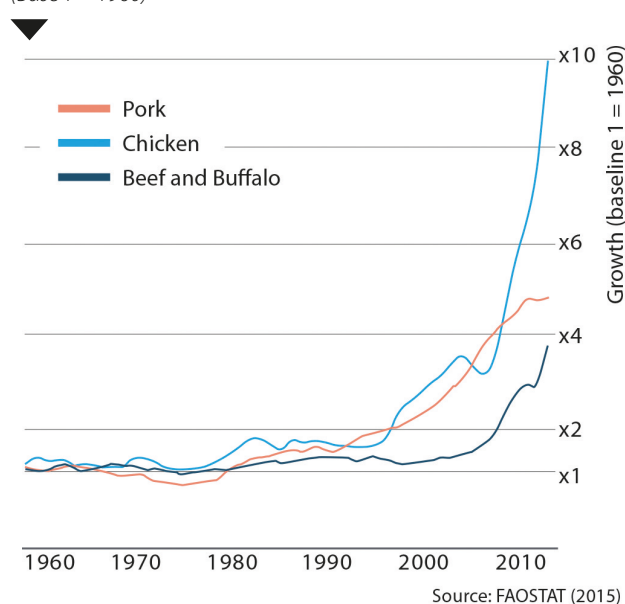
*Food consumption since 1986  
(in kilocalories per capita)*



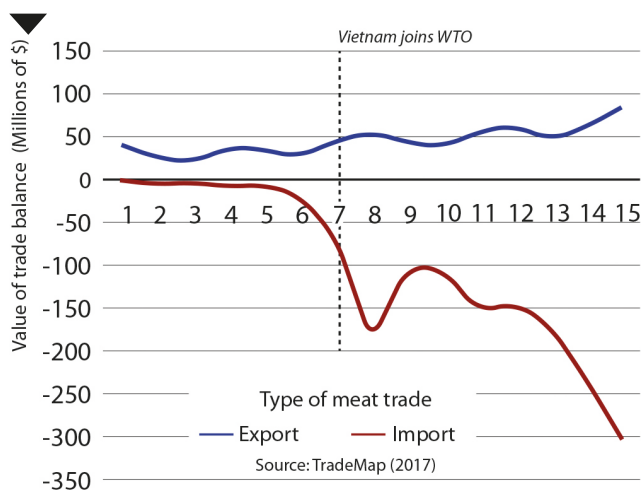
*Consumption of products of animal origin since 1986  
(in kilocalories per capita)*



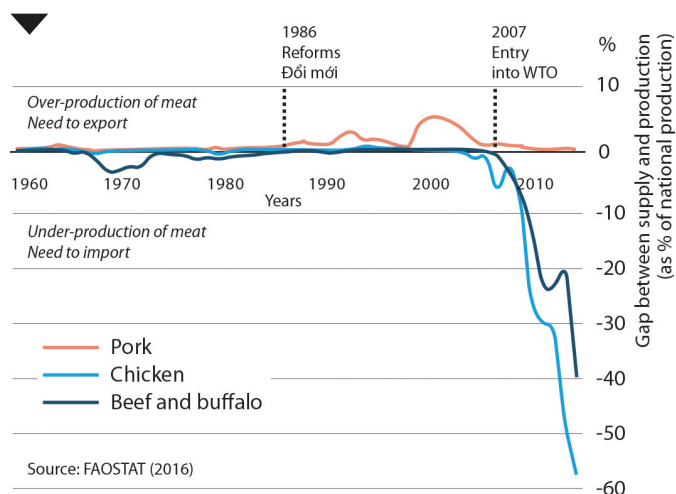
*Evolution of meat consumption since 1960  
(Base 1 = 1960)*



Evolution of Vietnamese meat trade value (import/export) since 1986



Evolution of national meat consumption balance since 1960



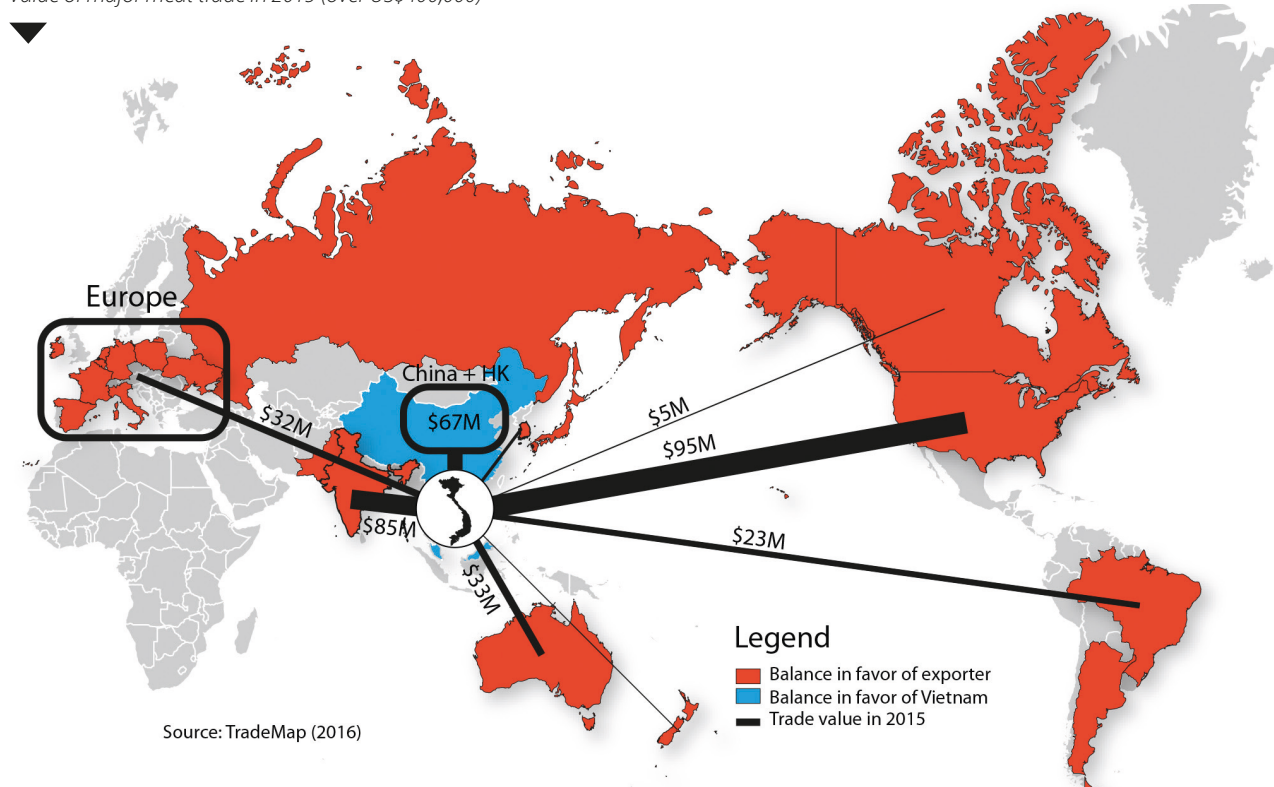
## Falling out with the WTO

Up to 2006, domestic meat consumption in Vietnam was based on national production. Between 1996 and 2001, there was even a slight pork surplus sold on foreign markets such as Hong Kong and Singapore. However, starting in 2006 the country recorded a sharp drop in its trade balance. The deficit grew by 1 million tons of meat between 2010 and 2011. This situation was directly related to the evolution of taxes following the country's entry into the WTO. Up to 2006, pork represented 90% of meat consumed in Vietnam compared to just 60% today. The consumption of chicken increased from 3 to 10 kilos per capita and per year between 2000 and 2011. With the diversification of diets, the Vietnamese began to enjoy eating chicken. As a sign of the times, the first fast food restaurant in Vietnam was a KFC in Ho Chi Minh City. The livestock sector in Vietnam must therefore adapt to a new environment open to international markets and face growing competition in the years to come.

KFC restaurant in Ho Chi Minh City



Value of major meat trade in 2015 (over US\$400,000)





## The livestock revolution in images

### Marketing: a badge of professionalism

With a 10% annual growth rate, the livestock sector in Vietnam is seeking to develop a modern, industrial and professional image. Unlike in developed countries, where bucolic imagery is used to sell industrial livestock products, the livestock sector in Vietnam emphasizes a business and technology-oriented message. Livestock farmers are presented in blue overalls. The layouts of farms project the idea of huge holdings that are as industrialized and productive as those in the Global North. This seeks to give a badge of professionalism to a sector that in reality falls far short of this industrial image.

### Present and future: the dual reality of the message

The livestock sector's message blurs the notion of time. Newspaper articles frequently mix the past, present and future to present the sector in the best light. Projects are planned, under construction, upcoming, in preparation. Projected volumes are achieved. However, these figures appear flimsy in the field.

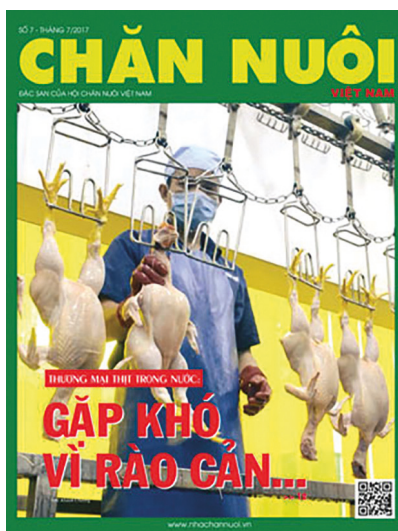
### International livestock exhibitions

International shows like VietStock in Ho Chi Minh City are occasions where the sector can best express its vision for the future. The sector is committed to building more and more mega-farms, feed plants and infrastructure. The line between what actually exists on the ground and what is projected to be achieved is blurry. The vision of the future sometimes appears to be disconnected from the constraints found in the field.

*Livestock exhibition in Ho Chi Minh City*



*An industry developing its media: the organization of livestock producers' journal in 2017*



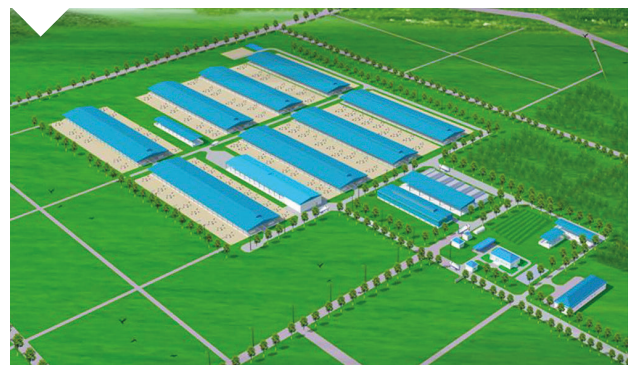
© <http://nhachannuoi.vn> (2017)

*The LIFSAP project*



© LIFSAP – World Bank (2014)

*Presentation of a dairy farm in Bình Dương*



© VNDC.com.vn (2017)

### The genuine professionalism of livestock producers

Beyond these events, professional organizations are multiplying. The journal *Chăn Nuôi* (Livestock) provides industry news every month. The digital journal <http://www.heo.com.vn/> is the main source of information for professional livestock producers. It reports changes in pig prices on the market. Dairy farmers can look at the website: <http://www.dairyvietnam.vn>. These sites, which are followed closely in the field, report sector news and the status of new technologies and techniques.

### Connected producers

The livestock webography in Vietnam is very dynamic and changes quickly. This way of communicating with producers demonstrates that the latter are quite connected and seek information on the internet. Thanks to smartphones, it is possible to rapidly reach large numbers of professional livestock producers. The development of content specialized in livestock production and livestock technologies is an indicator that the sector and its actors are becoming increasingly professional. These technological dimensions are critical for understanding the social reality on the ground.



# Chapter 2

## Statistics on livestock production in Vietnam

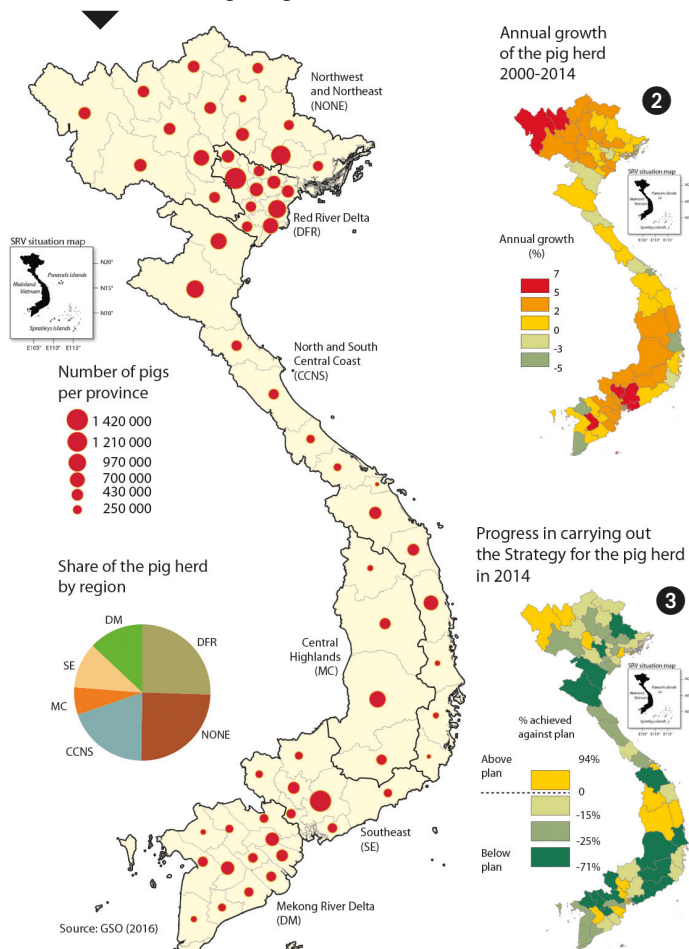
*J.-D. Cesaro, P. Bonnet, N. Hostiou, S. Cournut, Hoang Vu Quang*





# Concentrated monogastric livestock production

1. Distribution of pigs by province in 2015
2. Growth in pig headcounts between 2000-2014
3. Difference between the actual pig herd in 2014 and the strategic target for 2020



## Relocation of pig herds underway

During the 1995-2005 period, the Red River Delta, Mekong River and coastal regions saw a sharp rise in livestock numbers, concentrating more and more production in confined and densely populated areas. From 2005 onwards, the pig population stabilized, with the exception of mountainous and hilly areas where herds continued to grow. The government is seeking to continue this relocation dynamic, notably through the 2014 livestock restructuring act.

## Pig herd spreading into upland areas

Between 2005 and 2015, the highland and southeast regions saw considerable growth, with the pig population moving from 31% to 43% of the national herd. The southeast region has witnessed the strongest growth, with 900,000 heads in 1995 rising to nearly 3 million in 2015. If these trends continue, the Southeast region should outpace the Mekong Delta by 2020. However, these trajectories are not set in stone. The northern mountainous region was expected to surpass the Red River Delta, but since 2013, there has been an upward trend in the Delta. This upturn is taking place against a backdrop of enormous demand for meat in China. Between 2015 and 2016, China imported massive numbers of pigs from Vietnam. However, since the beginning of 2017, the Asian giant has closed its borders, triggering an unprecedented crisis in the Vietnamese pork sector.

## A less dynamic pig population

Between 1994 and 2016, the pig population grew from 16 million to nearly 28 million heads. This growth accelerated substantially between 2000 and 2005, with the addition of 7 million heads. However, between 2006 and 2016, the population stabilized at between 27 and 28 million heads, but the production of pig meat increased from 2.5 to 3.5 million tons. This increase is another indicator of the industrialization of pig farming.

## A pig population concentrated in the deltas

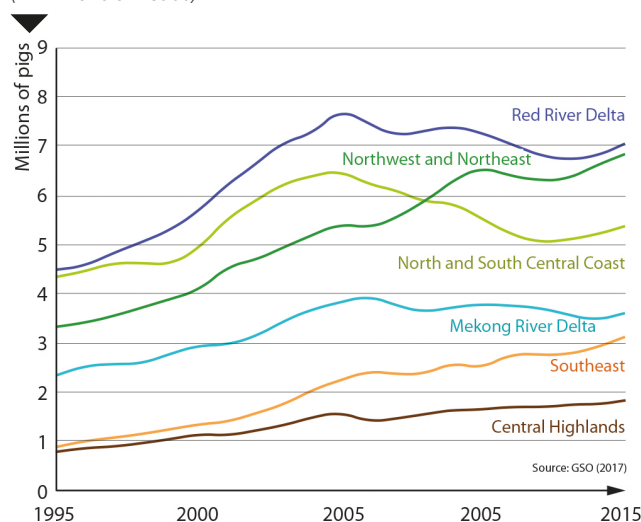
The distribution of the pig population mirrors the distribution of the human population. Until just recently, a small pen with one or two pigs was found behind every house. This geographic match is blurring as the sector continues to industrialize. The increase in pig production has led to a partial relocation of production to outlying regions, in hilly and mountainous areas. Several significant trends emerge from the figures for the 1995-2015 period.

Local pigs in the province of Điện Biên Phủ



© J.-D. Cesaro - CIRAD (2017)

Evolution of the number of pigs per region between 1995 and 2015 (in millions of heads)

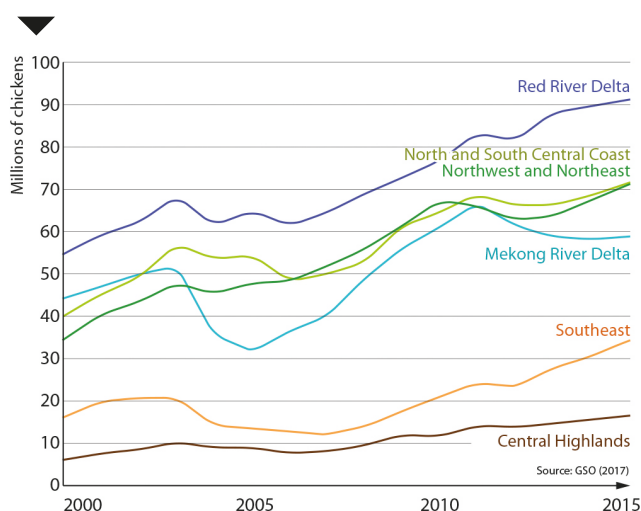


Duck farm near Bến Tre (Mekong Delta)



© J.-D. Cesario - CIRAD (2016)

Evolution of the number of poultry per region between 1995 and 2015 (in millions of heads)



## Redevelopment under industrial control in the south

It would take nearly five years to return to a similar level of production, particularly in the Mekong Delta and the Southeast region. In parallel, the Southeast region saw the strongest growth over the 2010-2015 period, notably the provinces of Đồng Nai, Lâm Đồng and Bình Phước. It is in these regions that the government's livestock strategy for 2020 appears to be the most effective. This growth has particularly relied on the emergence of intensive farms that are well integrated into the agro-industrial fabric woven around the large Ho Chi Minh City market.

## Small farmers still firmly anchored in the north

In the north, the provinces of Thái Nguyên and Điện Biên Phủ had interesting growth rates during the 2000-2014 period. Poultry farming in these regions is based on small family holdings. There is industrial development, but it is more limited in districts like Ba Vì, with former state farms reconverted into private holdings. In the Red River Delta, small intensive farms are emerging. They are using a model combining garden (*vườn*) + pond (*ao*) + small livestock farming (*chúồng*), also known as the VAC model. Even in the north, smallholder livestock farms are gradually being transformed by intensification and industrialization. However, the scale of production has retained more of a family character in the north.

## A growing poultry flock

Between 2000 and 2015, the poultry flock grew from 196 million to over 341 million heads. Since the first agriculture census in 1994, the number of poultry farmers has continuously increased. There are now over 10 million rural households with at least one chicken or duck. The large majority of poultry are raised on small village farms. This sharp increase is concentrated in the north of the country in the Red River Delta, and in the coastal and highland regions.

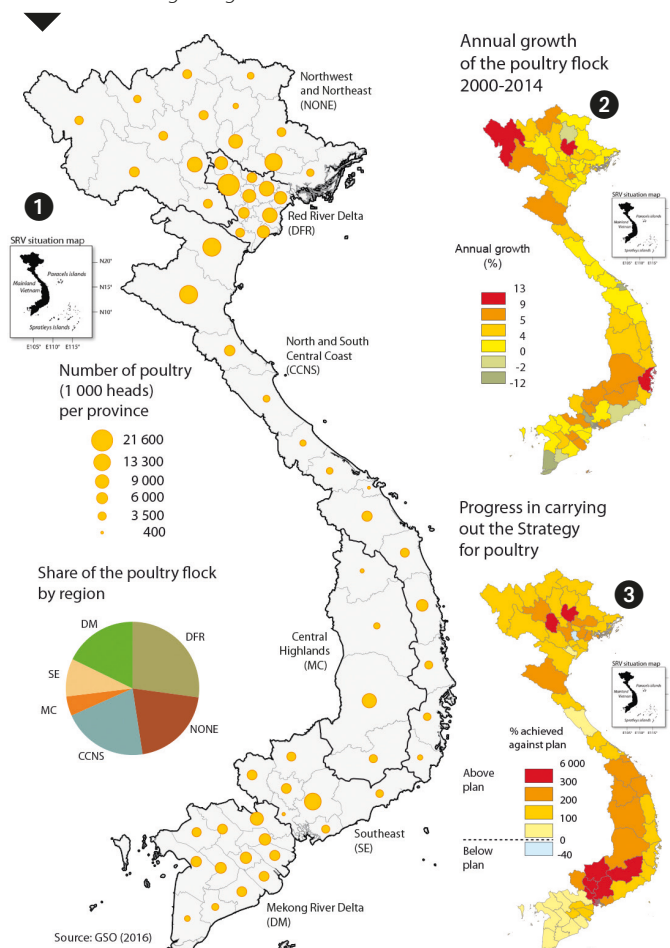
## Poultry farming close to water and population centers

Poultry farming and duck farming are not located in the same areas. Like pig farming, poultry farming is developing around consumption centers. Human population densities largely account for this distribution. Duck farming is developing in combination with rice cultivation. The ducks weed and naturally fertilize rice paddies. Duck farming consequently is more developed to the west of the Red River Delta and in the Mekong.

## Is poultry farming risky?

As a whole, the poultry flock follows the spatial distribution of the human population, which can be problematic. In January 2004, the H5N1 strain of avian influenza appeared in the poultry sector. Thailand also was affected. The deaths of three people led to systematic culling, particularly on free-range farms and for ducks. The flock collapsed. In 2011-2012, poultry production was subjected to a new reduction in the south. The flock declined in the Mekong region under the effect of preventive culling.

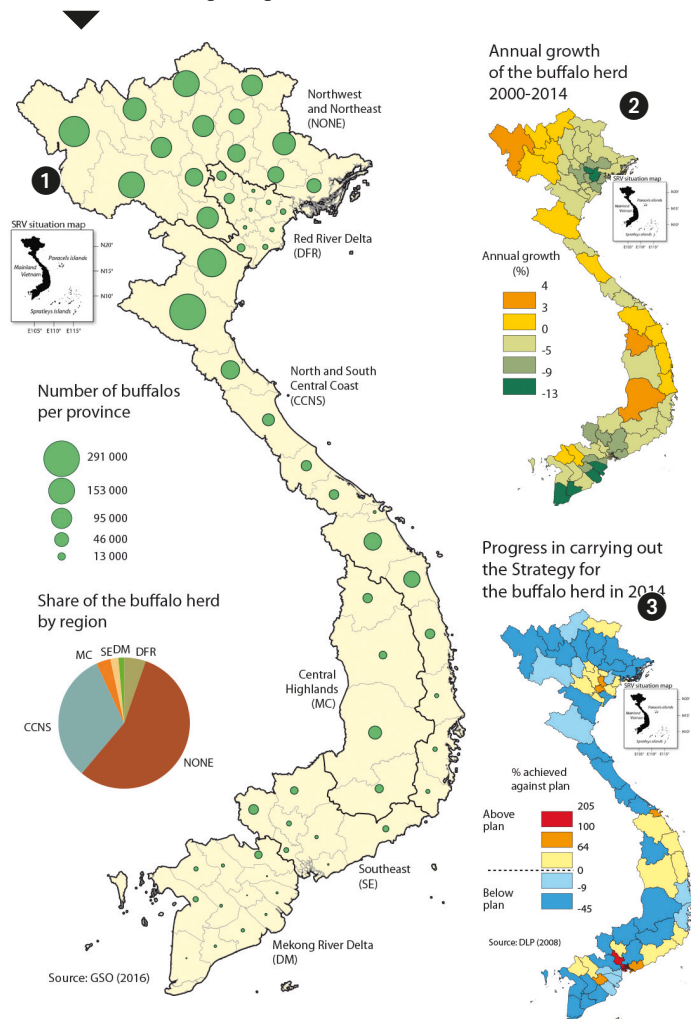
1. Distribution of poultry by province in 2015
2. Growth in poultry headcounts between 2000-2014
3. Difference between the actual poultry flock in 2014 and the strategic target for 2020





# Ruminant production confronted by space limitations

1. Provincial distribution of buffalo in 2015
2. Growth in the number of buffalo heads between 2000-2014
3. Difference between the actual buffalo herd in 2014 and the strategic target for 2020



## The buffalo: an animal emblematic of the north

In popular culture, the buffalo is the emblem of Vietnam. It is associated with the image of rice fields being worked. Buffaloes need water. Rice plains, watercourses and flood-prone areas are ideal for them. Buffaloes are favoured over cattle due to their strength and ability to adapt to wetland environments. Although they adapt well to deltas, it is a challenge to feed them in such densely populated areas. The vast majority of agricultural land is devoted to rice paddies, and no land is therefore available for pastures. When rice is growing, buffaloes must content themselves with grazing along the embankments. Sometimes the grass runs out, and the buffaloes are then sent to wooded hills or mountain areas. The geography of buffalo production shows a distribution concentrated in the northern part of the country, particularly in mountain areas. The province of Nghệ An has the largest buffalo population of Vietnam.

Working with a buffalo in the rice fields of Mai Sơn



© J.-D. Cesaro - CIRAD (2014)

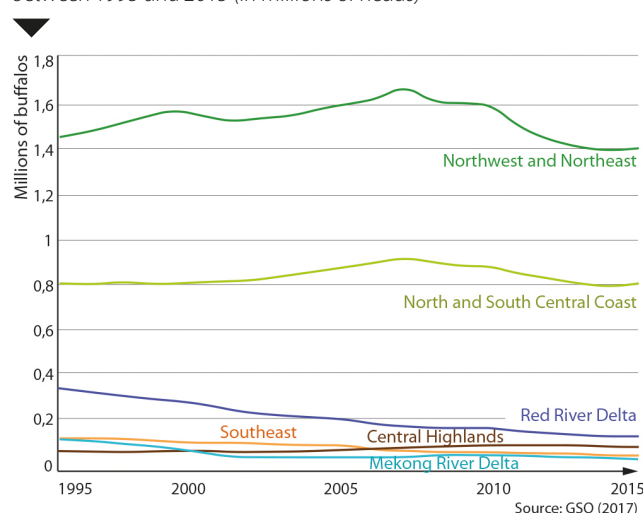
## A declining buffalo herd

Between 1990 and 2015, the buffalo population declined slightly, from 2.8 million to 2.5 million heads. Up to the early 2000s, the buffalo herd grew by tens of thousands of heads per year. From 2005-2006, the downward trend in the herd was confirmed, even in mountainous regions. Since 2014-2015, this decline has halted in the highlands and coastal regions.

## What is the future of buffalo in Vietnam?

The decline in buffalo production is largely due to the development of small tillers for rice farming. Gas-powered engines are competing with animal draught power. Moreover, the buffalo meat sector is competing with imports from India. It is difficult to know whether the buffalo population will be maintained at the national level in the future. However, there is resistance in hard-to-reach regions, notably in the north of the country. The possession of one or several buffalo remains an outward sign of wealth. Some families own large numbers of animals. The buffalo remains the symbol of a traditional society that, despite the economic growth and modernization of Vietnamese society, continues to endure.

Evolution of the number of buffalo per region between 1995 and 2015 (in millions of heads)







© J-D. Cesaro - CIRAD (2013)

## A herd located along the coast and in the mountains

Nearly half the herd are concentrated in the coastal and central regions. These regions benefit from a lower human population density. The provinces around major cities also have larger cattle herds, due in particular to fattening farms. The largest herd increases are in the Mekong Delta.

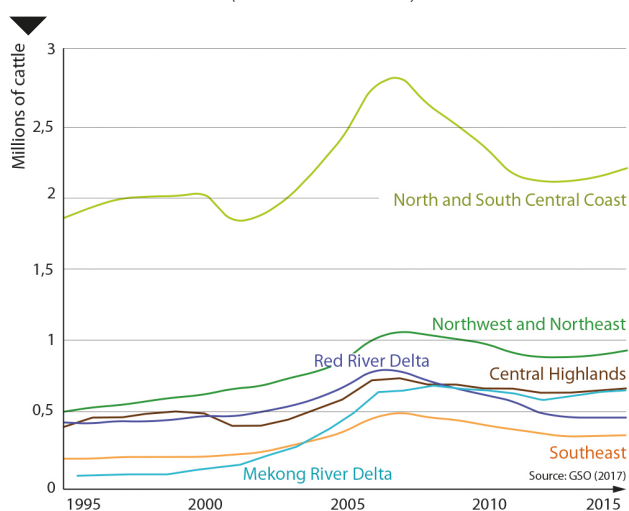
## Cattle fattening in the deltas

In the country's two major deltas, medium-size family farms are developing cattle fattening activities. Hoping to diversify their sources of income, these families see cattle production as a means to develop a profitable farming activity near major consumption centres. The delta regions benefit from having a considerable amount of rice straw that can be used as livestock feed.

## Intensification of fodder production

The intensification of fodder systems is a potential option for the development of cattle farming. Today, few small farmers dare to devote their land to cultivating elephant grass. Only dairy farmers are attempting crop specialization. The dairy herd accounts for barely 5% of the total number of cows in the country. Fodder crops are frequently grown in spare spaces between fields, by the side of a road and along river banks, and serve more for agricultural diversification than farm specialization.

Evolution of the number of cattle per region between 1995 and 2015 (in millions of heads)



## Growth of the cattle herd since 1990

In contrast to buffalo, cattle have increased significantly in number, rising from 3.6 million heads in the early 1990s to nearly 5.2 million heads today. A peak was reached in 2006 with 6.7 million heads. The number has decreased since. This sharp drop of nearly 1.6 million heads in about six years has never been explained.

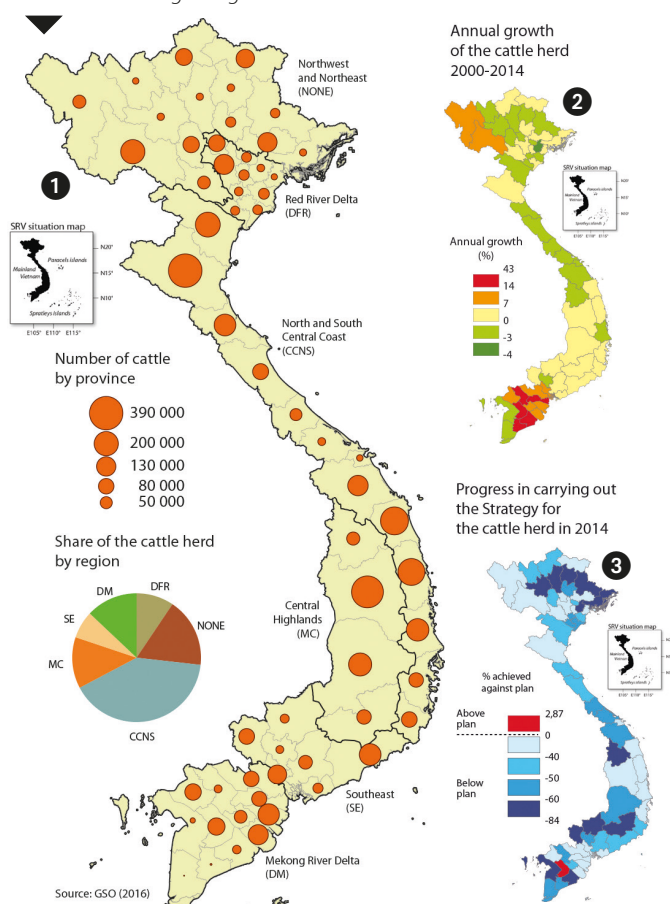
## A demand-driven herd but under constraints

Vietnam is importing more and more beef from Australia, the United States and, more recently, India, because increasing demand is not being met by the development of the local sector. A local sector does exist but it faces constraints, in particular a lack of space. Ideally, local people communities could benefit from this recent growth in beef consumption, but Vietnam has never been known for beef farming. It is difficult to develop a fattening activity to enable the country to be self-sufficient with regard to beef. Human population densities are high and every scrap of land is under cultivation, leaving little room for beef farming.

## Lack of recognition of extensive farming

Most cattle livestock currently are mobile. Livestock farmers use collective pastures and their animals eat the crop residues left in fields (maize stalks, cassava leaves), but when fields are under cultivation, animals must move towards the forests. Local government administrations have little interest in grazing areas. From a legal land use perspective, pastures do not exist, and this livestock farming is frequently associated with poverty reduction programs.

1. Provincial distribution of cattle in 2015
2. Growth in the number of cattle heads between 2000-2014
3. Difference between the actual cattle herd in 2014 and the strategic target for 2020



## 2020 livestock strategy: a policy response

### Market liberalization and protectionist measures

Between 2006 and 2008, several phenomena had an impact on the livestock sector in Vietnam. First, as a member of the WTO, Vietnam could no longer control food prices. Prices were supposed to be determined by the markets. Then, between 2007 and 2008, the global economic crisis triggered significant speculation on agricultural commodities markets, which led Vietnam to temporarily halt rice exports. Between 2009 and 2010, the economic crisis affected the Vietnamese banking system, causing a devaluation of the dong. Under these conditions, the Vietnamese livestock sector found itself confronted with a galloping growth in frozen meat imports (chicken and pork). The government rapidly decided to raise customs duties on the imported consignments. This increase in duties prevented the market from being flooded with low-cost products. However, they did not stop imported meat from entering the market. At the same time, MARD developed a strategy to restructure the livestock sector.

### The 2020 livestock strategy

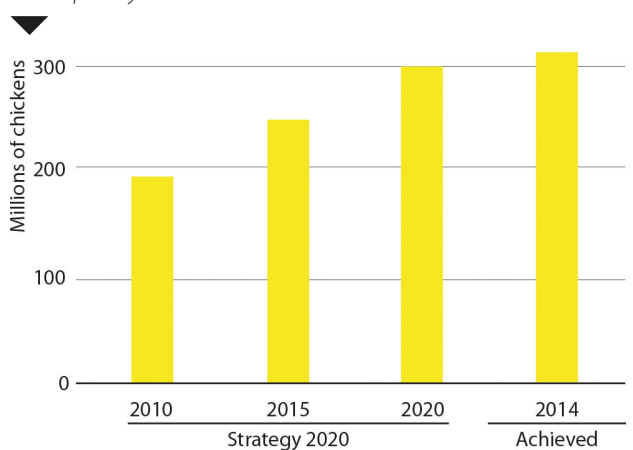
In early 2008, the prime minister approved Decision N°:10/2008/QĐ-TTg, the Strategy on Animal Breeding up to 2020. This decision profoundly changed the direction of agricultural development policy. The government took note of the strong competition on international markets and decided that the livestock sector should be rapidly industrialized to cope with international dumping and to satisfy domestic demand. The principle objective of the decision was to define the new work framework: "By 2020, the animal breeding industry will basically switch to commercial farm and industrial production in order to meet in priority domestic and export demands for quality foods." With this aim in mind, the livestock department fixed ambitious goals. Pig production was to increase from 27 to 35 million pigs, and poultry production from 180 to 310 million heads.

Objective of the 2020 strategy and achievement by 2014 for the pig herd



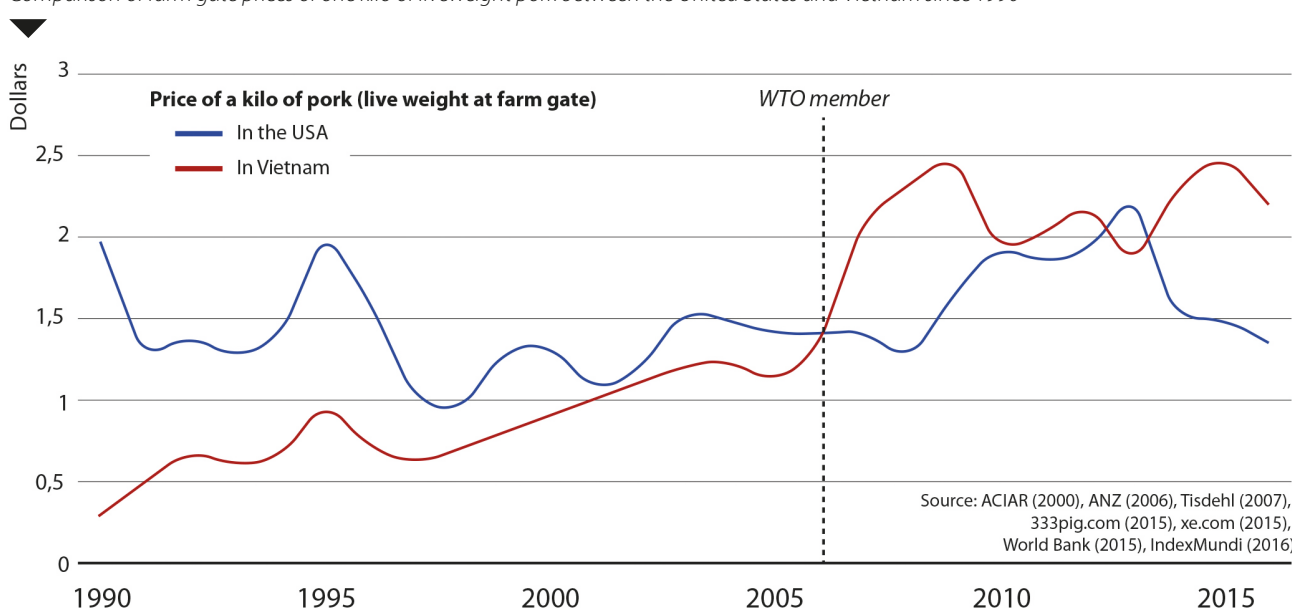
Source: DLP (2008), FAO (2017)

Objective of the 2020 strategy and achievement by 2014 for the poultry flock



Source: DLP (2008), FAO (2017)

Comparison of farm gate prices of one kilo of liveweight pork between the United States and Vietnam since 1990



Source: ACIAR (2000), ANZ (2006), Tisdahl (2007), 333pig.com (2015), xe.com (2015), World Bank (2015), IndexMundi (2016)

## Are the 2020 objectives unreachable?

Is this strategy ambitious – or too ambitious? The country's capacity to meet its objectives were widely questioned. The first figures rapidly became available. For pigs, the sector was falling short on the various milestones in terms of animal numbers and meat production. While the government planned on a herd of 32 million heads by 2015, the pig herd was stagnating at less than 27 million heads in 2014. In contrast, for the poultry sector, the objectives were largely met and were even ahead of the schedule. In 2014, the sector had surpassed the 2020 goal. For the dairy sector, the situation was mixed. Production is growing but less rapidly than planned.

## The sectoral objective of industrialization

It would obviously be simplistic to consider the livestock strategy for 2020 as a simple decision about production planning. A set of actors up and down the production chain were considered. According to the strategy, 50% of animal feed must be industrialized by 2020. Land must be set aside for the development of large industrial farms, and the value chains must better integrate production and industrialize. This is a sectoral strategy.

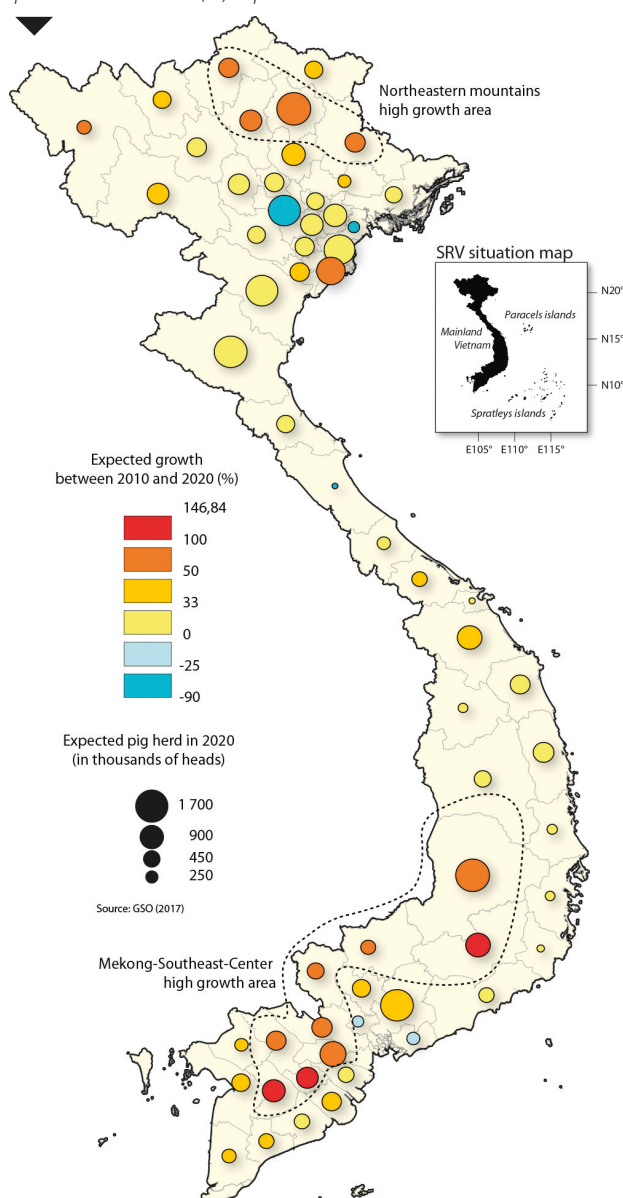
## The 2014 livestock restructuring policy

In 2014, MARD passed Decision N° 984 approving the restructuring plan for the agriculture sector in which livestock plays an important role. This decision aimed to improve the value added of the sector while guaranteeing sustainable development principles. The first objective was to “gradually move livestock commercial farms (*chăn nuôi trang trại*) from areas with high human population densities (deltas) to regions with lower human population densities (mountains) by creating regions free of all animal diseases far from cities and dwellings.”

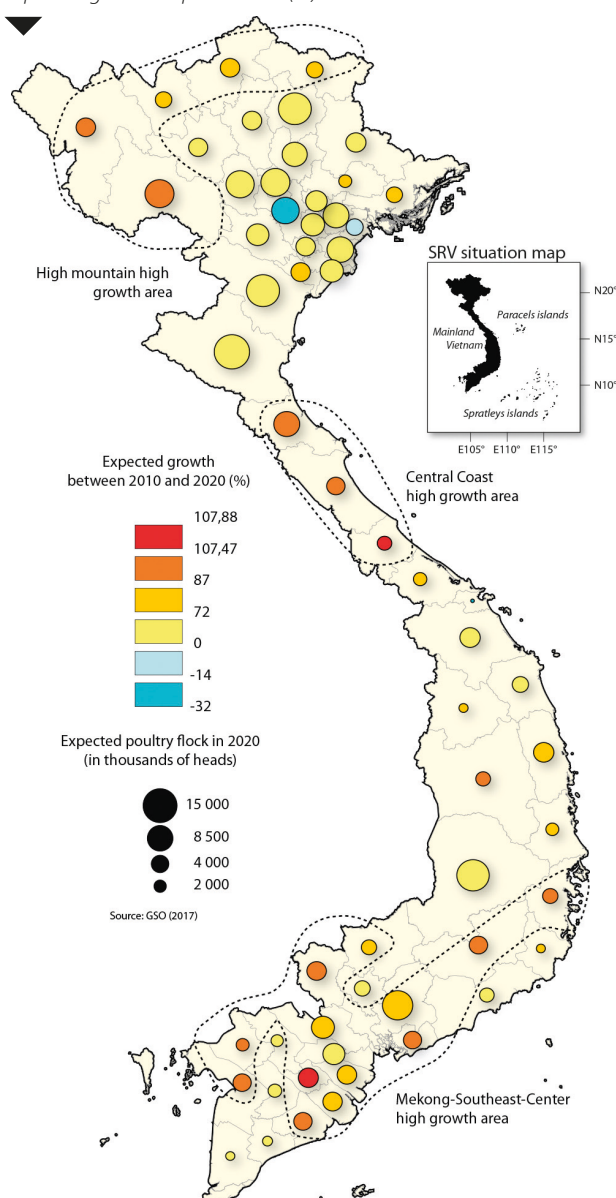
## Towards areas for livestock production

In each location, livestock development areas were to be created in order to accommodate targeted investments. With this policy, the government is seeking to limit the development of industrial livestock farms close to residential areas. Applied at the local level, this policy is even attempting to change the regional geography of livestock production. Recent trends indicate that the 2020 livestock strategy and the restructuring policy have worked well. In 2018, the government adopted a new law on livestock development offering greater incentives for the development of more industrial models.

Pig production growth targets by 2020:  
production increase (%) expected between 2010 and 2020.



Poultry production development objectives by 2020:  
expected growth in production (%) between 2010 and 2020





# The *trang trại*: a tool for agriculture development

## What is a commercial farm (*trang trại*)?

The concept of a “farm” does not have the same meaning in Vietnam as it would in the United States or France. In the early 2000s, the Vietnamese government implemented a development policy known as the “commercial farm economy” (*kinh tế trang trại*). A *trang trại* is a large commercial farm whose production is largely intended for sale. Family farms involved in both subsistence and commercial farming are not entitled to call themselves *trang trại*. This name is granted to commercial farms whose turnover exceeds a defined threshold.

## An often-misunderstood category

On the GSO website, data on commercial farms are the first to appear on the agricultural statistics page. An uninformed foreign expert could quickly confuse commercial farms with agricultural holdings and attribute the raw data presented to the category “Number of farms in Vietnam”. This situation is becoming increasingly apparent in international reports, which, in the interest of speed, only note the number of commercial farms and neglect the millions of farm holdings which have a livestock activity. It is essential to fully understand the scope of this definition.

## The first definition of *trang trại* in 2000

In 2000, the government decided to define commercial farms according to the following criteria: total revenue, agricultural area and number of animals present on the farm. Several specialities existed: annual crops, perennial crops, livestock production, forestry, and mixed. In 2001, the country counted 61,000 farms which met these criteria (ARC, 2001).

Definition of farms according to MARD's Circular No. 27/2011/BNNPTNT of 2011

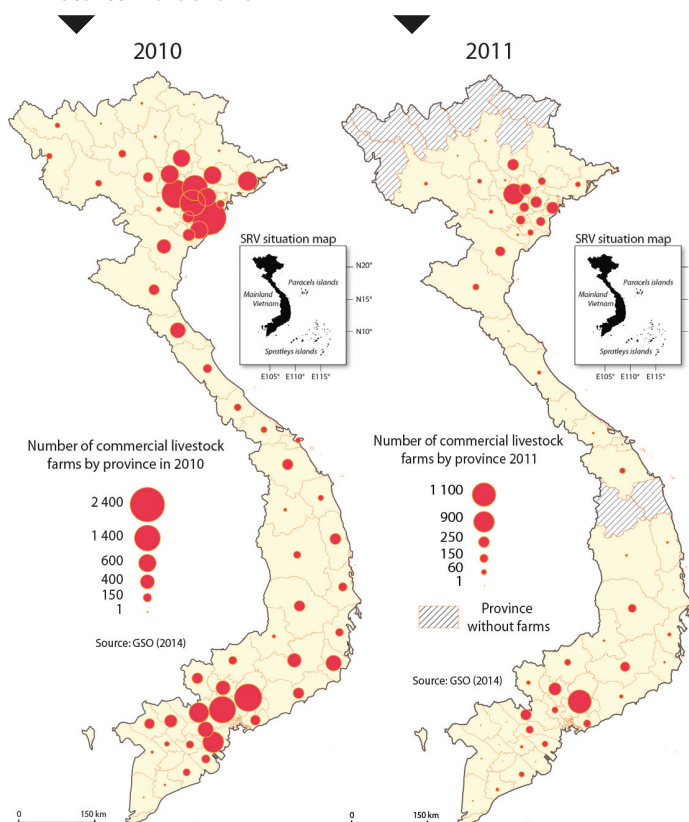
| Farm type                                    | North and Coastal region  | South and Center          |
|--|---------------------------|---------------------------|
| Annual crop<br>Perennial crop<br>Aquaculture | 2.1 ha<br>700 million VND | 3.1 ha<br>700 million VND |
| Forestry                                     | 31 ha<br>500 million VND  |                           |
| Livestock                                    | 1 000 million VND         |                           |

An intensive pig farm in the district of Phù Đổng (Red River Delta)



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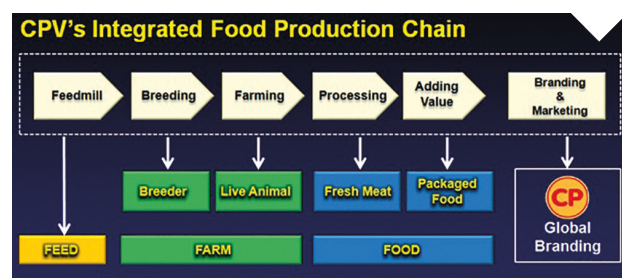
Impact of regulatory change on the spatial distribution of *trang trại* between 2010 and 2011



## Change in the definition between 2010 and 2011

By the end of 2010, 145,880 farms, or 1.4% of all agricultural households were recorded as specialized holdings (GSO, 2011). The number of livestock farms increased from 1,700 in 2001 to over 23,500 in 2010. In 2011, MARD decided to change the legal definition of commercial farms. The thresholds were raised to limit the number of commercial farms. The government in effect wished to allocate them grants and agricultural land and sought to reduce the number of beneficiaries. In 2010, Vietnam had more than 145,000 *trang trại*; in 2011, there were just 20,100. Compared to other types of production, livestock farms were relatively less affected by this new definition. The number of commercial livestock farms remained 6,267 in 2011, accounting for 1/3 of all commercial farms.

Concept of integrating value chains and contracting farms presented by the firm Charoen Pokphand (CP)



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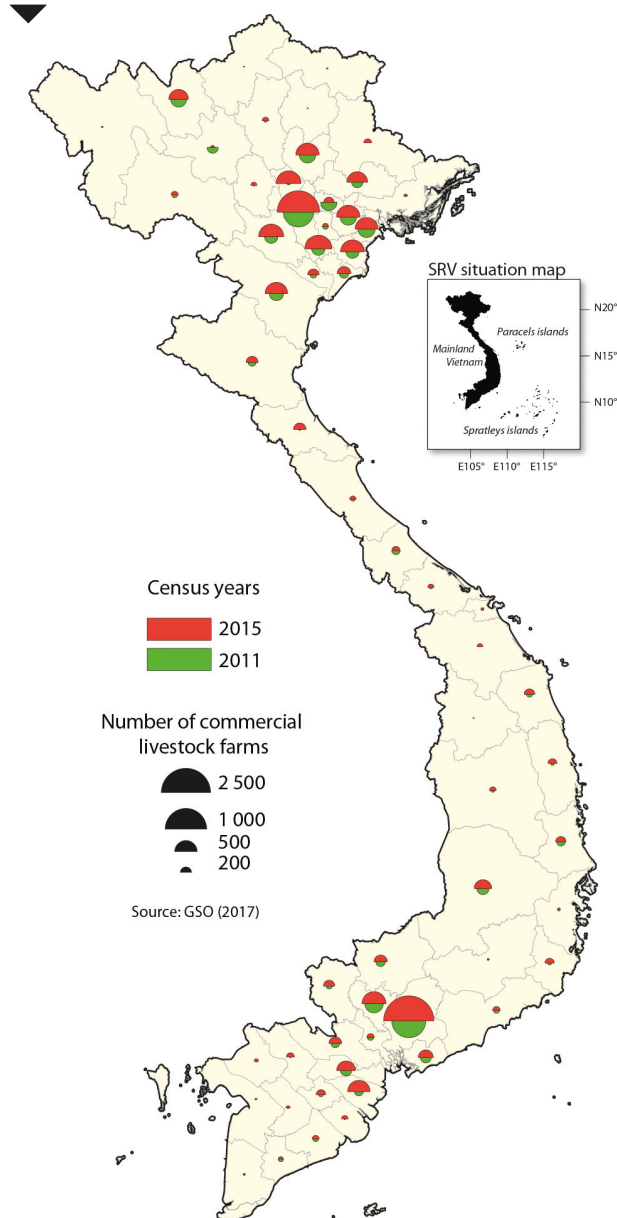
## Livestock farms a majority

Since 2011, the majority of *trang trại* have been commercial livestock farms. Vietnam's entire financial system of agriculture banks is redirecting funding streams. State grants are being directed first and foremost to this category. The agriculture credit ceiling stipulated by law is higher for commercial farms than for family farms. Commercial farms are the first to benefit from funding. Access to land lots has been simplified for livestock producers. When development programs are implemented, commercial farms are the first beneficiaries.

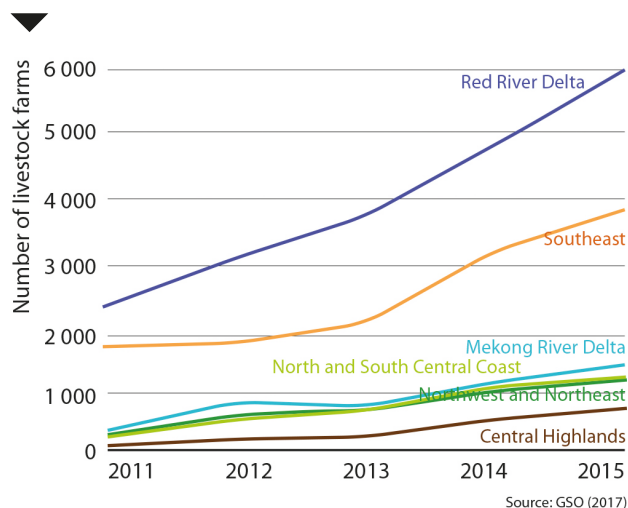
## Livestock farms: a regional specialization

Over half of the country's commercial farms are in the Red River Delta, while the Southeast region accounts for only one-third of the total. Livestock farms largely predominate in the north of the country and represent between 75 and 100% of the commercial farms. In the south, the situation is more varied, with the presence of perennial crop and aquaculture farms. Around Ho Chi Minh City, livestock farms are largely over represented, in particular in the provinces of Đồng Nai, Mỹ Tho and Bến Tre. In these three provinces, the size of livestock farms surpasses the national average.

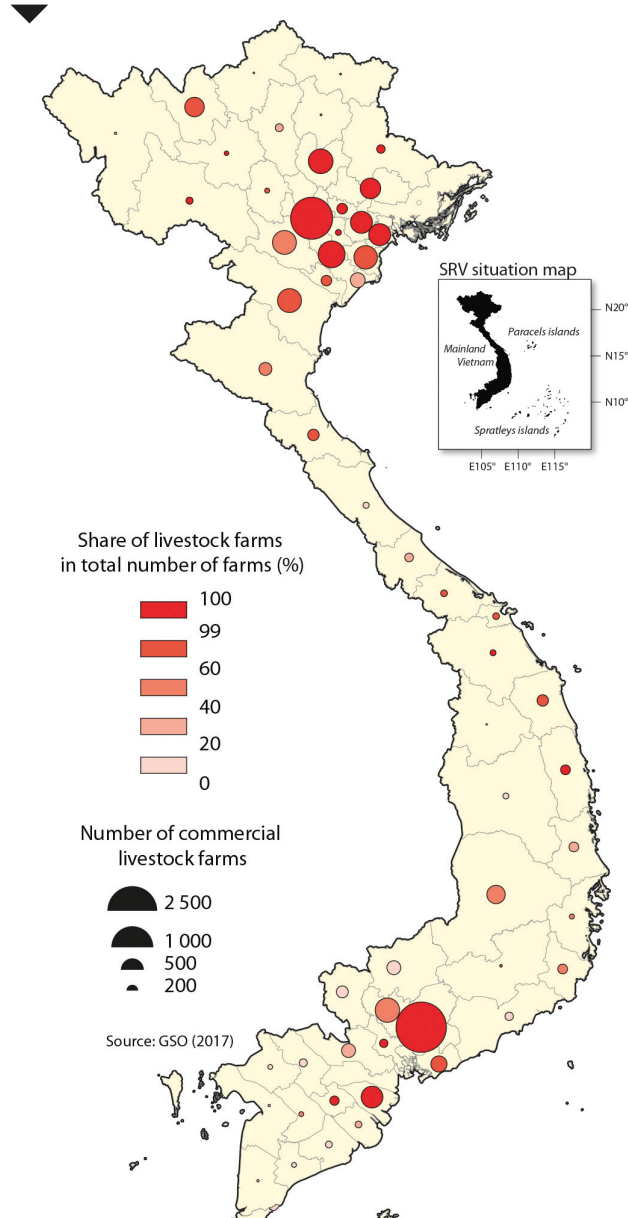
Evolution in the number of livestock farms by agroecological region since 2011



Evolution in the number of livestock farms between 2011 and 2015



Share of livestock farms in the total number of farms per province in 2015



# Meat production: improving productivity

## Local meat production located near markets

The volume of meat produced by province can be understood first by the local population present, and then by the pig herd in the province. This rule has one exception: Ho Chi Minh City. The largest city in the country has almost entirely relocated slaughterhouses to the outskirts of the city, notably in the province of Đồng Nai. This phenomenon also is occurring in the north around Hanoi. Production growth is negative there while growth rates in the surrounding provinces are positive. This situation indicates that meat production is gradually moving out of large metropolitan areas.

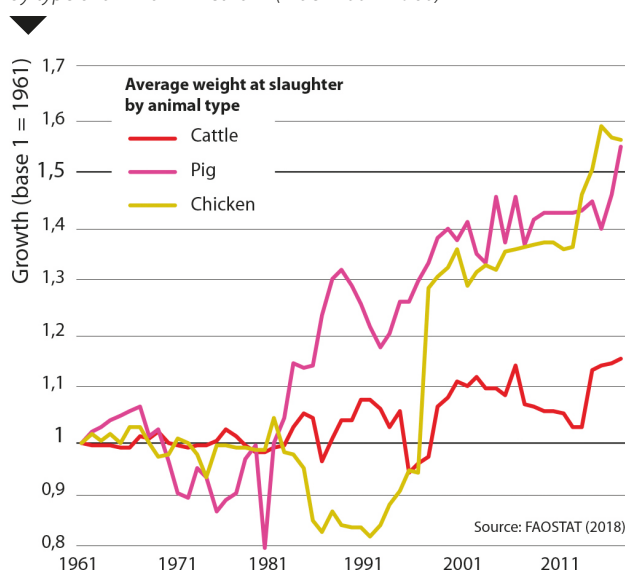
## Strong localized growth

Between 2010 and 2014, the growth rates in the provinces of Đồng Nai, Bình Dương, Bà Rịa and Bình Phước varied between 25% to over 50%. It was the same for the provinces of Phú Thọ, Thái Nguyên and especially Lạng Sơn. These rates are an indicator of the gradual relocation of production towards more outlying regions. The government is investing in modern slaughterhouses that meet international standards. To control production costs, these new facilities must be industrial sized, which raises questions regarding their location. Regions on the outskirts of large cities (10 km away) are convenient areas for the industrialization of the sector.

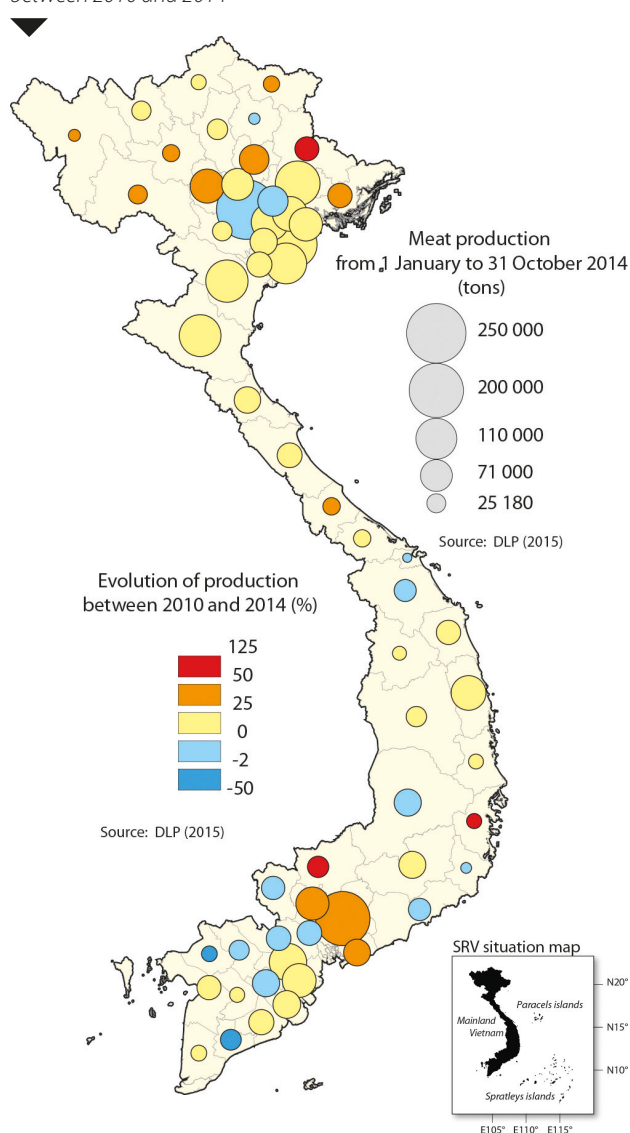
## Improved yield

The evolution of the average weight at slaughter of monogastric animals has increased since 1960. Chickens have gone from an average weight of 900 g to over 1.6 kg, while the weight of pigs at slaughter has increased by more than 27 kg compared to 1960. The carcass weight of animals has increased considerably since the 2000s, notably thanks to the evolution of animal genetics with the introduction of new 'exotic' species. The second contributing factor is the evolution of production and nutrition processes. The production of cattle and buffalo remains more traditional. Productivity gains therefore are lower compared to sectors which are industrializing.

Evolution of average weight at slaughter by type of animal in Vietnam (index 100 = 1960)



Meat production in 2014 and evolution of production between 2010 and 2014



LIFSAP pig meat market in Đồng Nai





# Chapter 3

## Controversy over animal feed

*G. Duteurtre, P. Bonnet, D. Sautier, Hoang Vu Quang, M. Blanchard*



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*Industrial feed on an intensive farm in Son La*

# Intensification of crop and livestock production

## A revolution in two phases

The growth in animal production was based on the boom in crop production. In reforming collectivized agriculture, Vietnam departed from a system of shortages and became self-sufficient in rice beginning in 1995. The country even started to export cereals in 1997. High-yielding varieties were introduced for rice (1980), sweet potato (1986), maize (1994) and then cassava (2000).

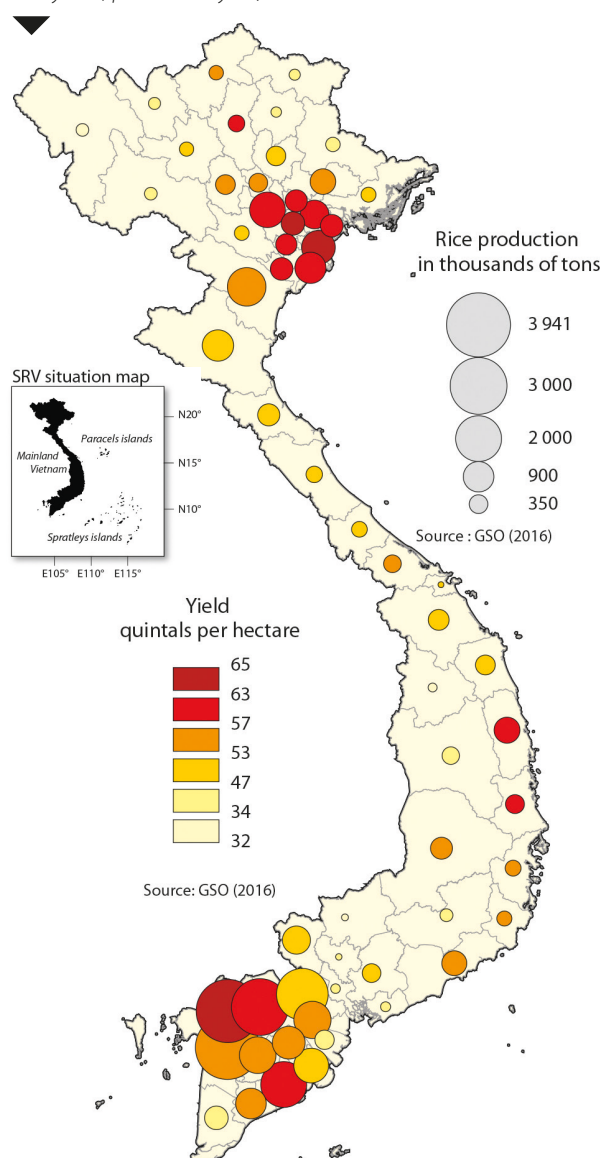
Today, yields per hectare reach up to 7 tons for rice, 4.5 tons for maize, 18 tons for cassava and 10 tons for sweet potatoes. Soybeans are in last place with a yield of under 2 tons per hectare. In 2013, over 60 million tons of the key annual crops were produced. Food production is growing at a rate of around 1.6 million tons per year. The rice crop today represents 90% of the country's cereal resources.

Fertilizing a rice field

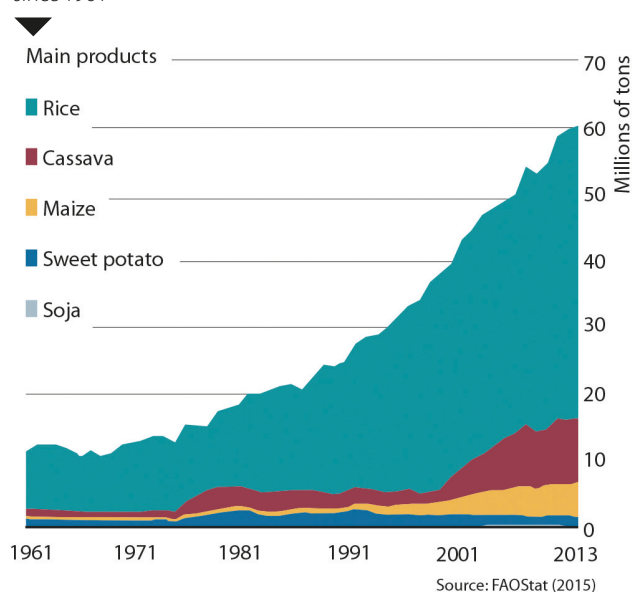


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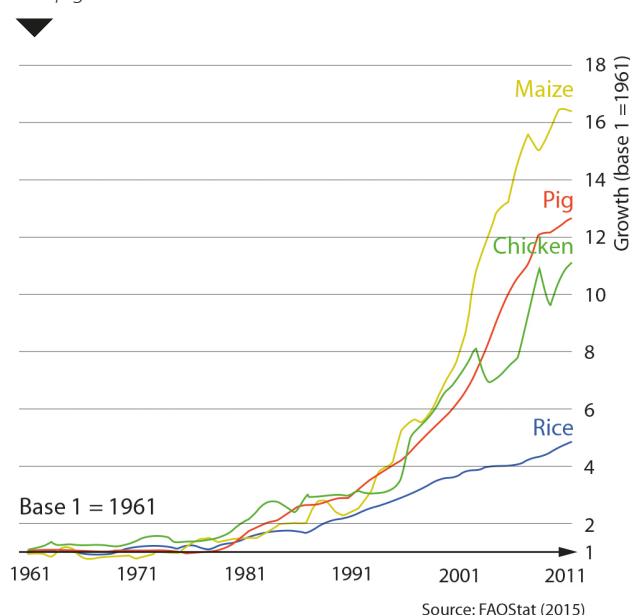
Rice: production (thousands of tons) and yield (quintals/ha/year) in 2015



Evolution of the production of the main agriculture products since 1961



Evolution of the production of rice and maize crops and pig and chicken meat since 1961





## “Pre-industrial” animal feed

At the end of the 1990s, the composition of the average ration for fattening pigs in the north of Vietnam was based on rice. Rice bran accounted for 48% of the average national ration. Broken rice was 33% of the total. In sum, 81% of pig feed came from rice. Maize (7%), sweet potato (6%) and cassava (6%) made up the rest. Starting from the 2000s, the proportion of maize in rations went up to 40% in some regions, but maize was rapidly replaced by industrial feed. Today, local maize is processed by feed factories and sold to livestock producers as concentrates.

## Animal and crop growth evolving together

By comparing the growth of animal and crop production, a coevolution phenomenon of the crop revolution and the livestock revolution may be observed. Rice production was five times higher in 2015 than in 1960. The production of chicken and pork was multiplied by 11 and 12.5 respectively. The increase in rice production is therefore providing a solid foundation for developing livestock production, even if it remains insufficient to feed all of the livestock. As for maize, its production is 16 times higher than in 1960.

## The geographic distribution of raw materials

Rice is found in the deltas, while maize and cassava are grown in highland areas. The number of crop cycles and yields are higher in the plains than in the mountains, and generally are higher in the south of the country than the north. To make the most of the opportunity to use agricultural products in animal feed, factories are located near delta and mountain regions.

Harvest and transport of maize to Sơn La

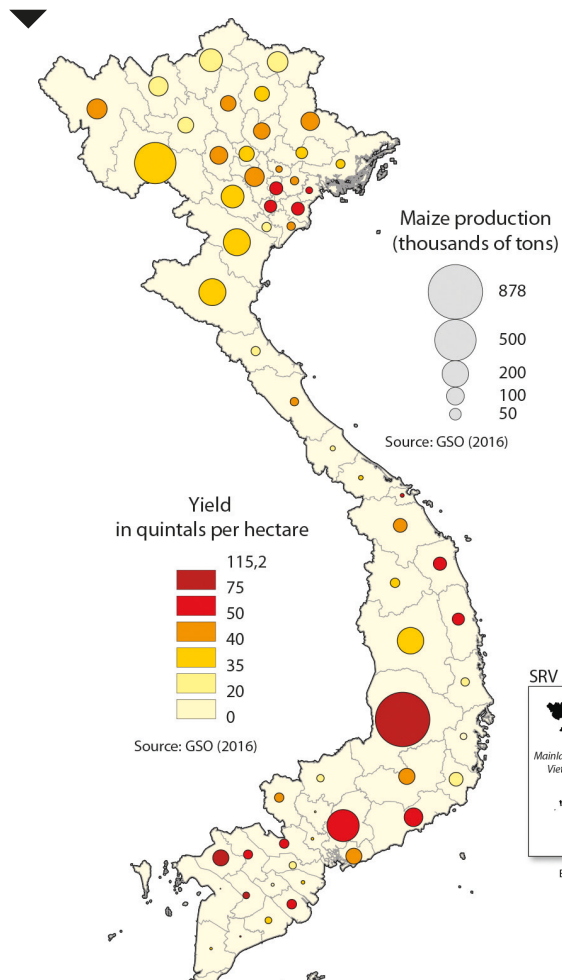


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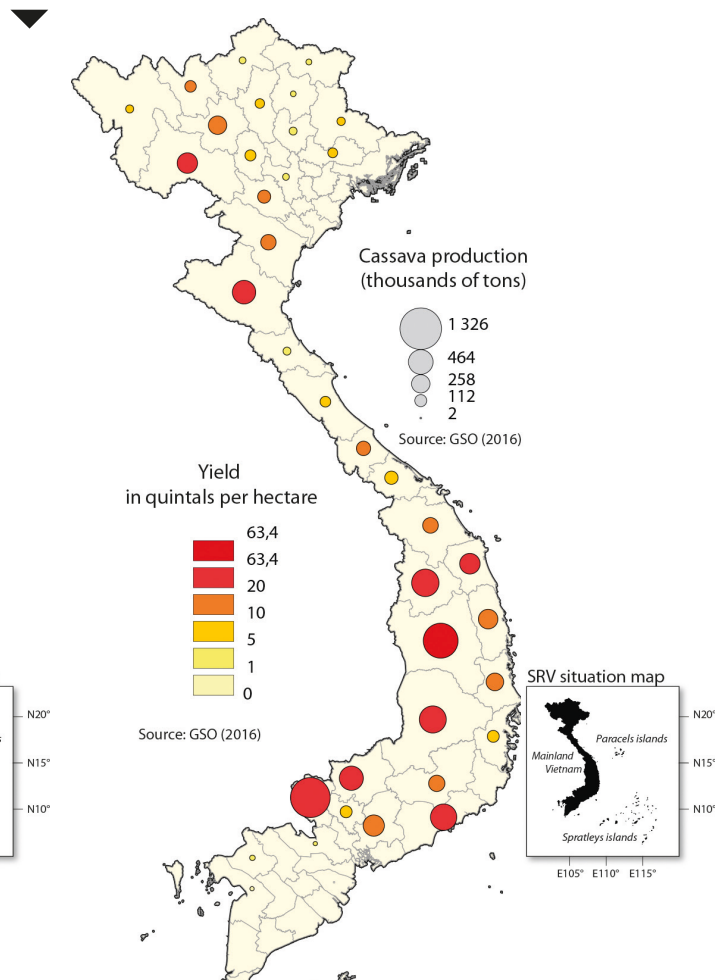
## Testing GM crops before dissemination

In 2014, the Vietnamese government authorized the cultivation of four varieties of genetically modified (GM) maize resistant to insects and/or herbicides; two were produced by Monsanto, and two by Syngenta. The government expects that half of all farms will cultivate GM crops by 2020. According to official data, 45,000 hectares (4% of the total) were planted in 2015 alone. The pressure of imports against a backdrop of climate change has led the government to adopt this new crop strategy.

Maize: Production (thousands of tons) and yield (quintals/ha/year) in 2015



Cassava: Production (thousands of tons) and yield (quintals/ha/year) in 2015

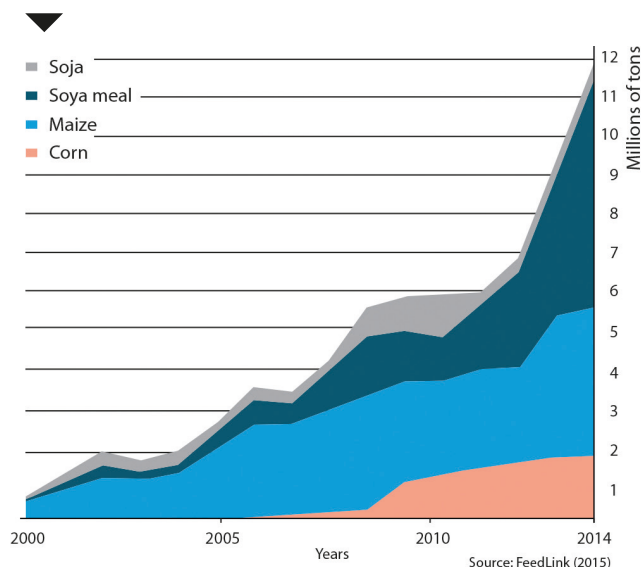


# Surging livestock feed imports

## Imports driven by demand

In 2000, soybean and maize imports amounted to approximately 500,000 tons. These imports reached almost 12 million tons in 2014 and 13.5 million tons in 2015. The first strong growth occurred between 2000 and 2003, then between 2004 and 2007, and then again between 2012 and 2015. This last increase was particularly impressive in terms of volume but corresponded to the same rate of growth. Indeed, in each wave of growth, imports essentially doubled in volume. However, these surges of imports did not always involve the same products. Between 2000 and 2010, maize imports accounted for the majority of imports, while after 2010, soybean imports increased sharply.

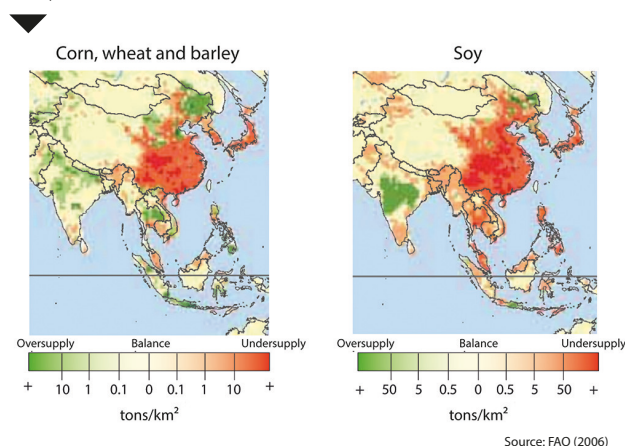
Evolution of imports of the main agricultural products used for animal feed since 2000



## Asia's increased dependence on soybeans and maize

Asia is facing a very strong imbalance between the production of corn and soybean and demand from livestock farms, particularly in China and Vietnam. This region of the world cannot meet the rising demand for animal products without importing increasing amounts of agricultural raw materials for their herds. This question is crucial to the sustainability of Asian livestock systems.

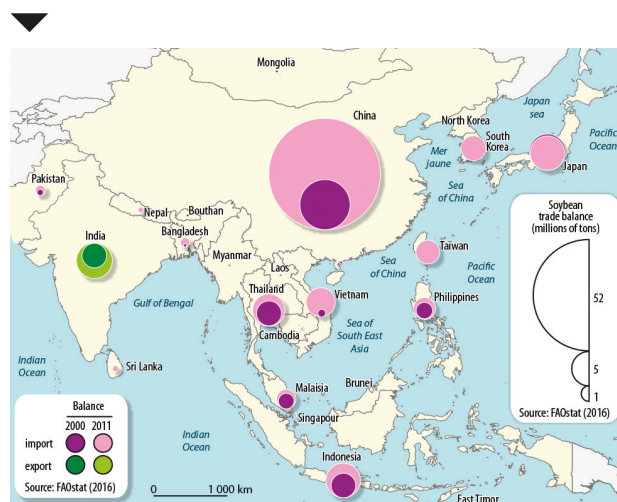
Estimation of agricultural output (maize, wheat, barley, soybean) compared to demand from livestock farms in 2000



## Sharply increasing soybean imports

Since 2008, soybean imports have been growing at a rapid pace. Between 2012 and 2015, they literally tripled. This development is being driven by the increasing needs of industrial livestock farms, and particularly poultry farms. This increase in volume is in fact coupled with a very strong increase in value. According to the FAO, this development in Vietnam is greater than in any other Asian country relative to the volumes imported in the early 2000s. Vietnam's soybean imports grew four times faster than China's. This situation is causing stock ruptures on an animal feed market which is itself increasing in overall value by 10% per year.

Comparison of soybean trade balances in Asia between 2000 and 2011



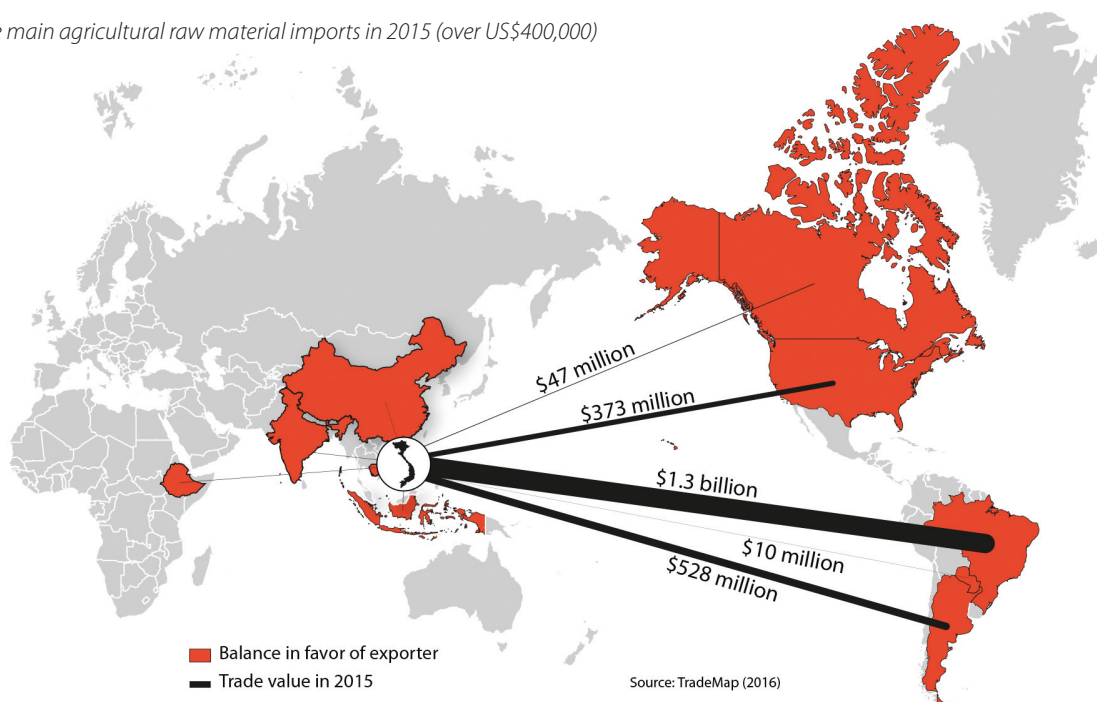
## Asia's overall impact on global soybean trade

Global soybean trade has increased from 8 million tons in 1990 to over 65 million tons in 2011. Three quarters of this goes to Asia, of which East Asia (China, Japan, Korea) alone accounts for 64% of the overall total. For maize, East Asia currently imports 39 million tons, compared to 29 million in 1990. Its dependence on maize is lower because the region's own output fills a large part of its needs. This region nonetheless imports about one third of world maize flows.

Sacks of animal feed arriving in Ho Chi Minh City







## Sharply increasing values

According to international trade statistics, the value of Vietnamese imports of the main ingredients for livestock feed is at a record high. In 2014, imports of maize were valued at US\$1.2 billion while soybean imports exceeded US\$873 million. In 2001, these same imports were just US\$3.5 million for maize and US\$28 million for soybeans. Between 2008 and 2015, the increase in the price of raw materials was 10 times higher than that of volumes. Faced with this situation, the government decided to lower taxes on imports.

## Evolution of taxes on imports

In November 2014, the National Assembly adopted law 71/2014/QH13 concerning taxes on soybean imports. Between 2014 and 2015, these taxes dropped from 2% to 0%. For other raw materials, they dropped from 10% to 2%. This situation has contributed to a steep increase of imports, thereby stimulating the volume of the animal feed industry. At the same time, bountiful soybean harvests in Brazil and Argentina helped to reduce soybean prices between 2013 and 2015. In contrast, the price of maize continues to increase on international markets. Even though volumes are relatively stable, the bill continues to increase.

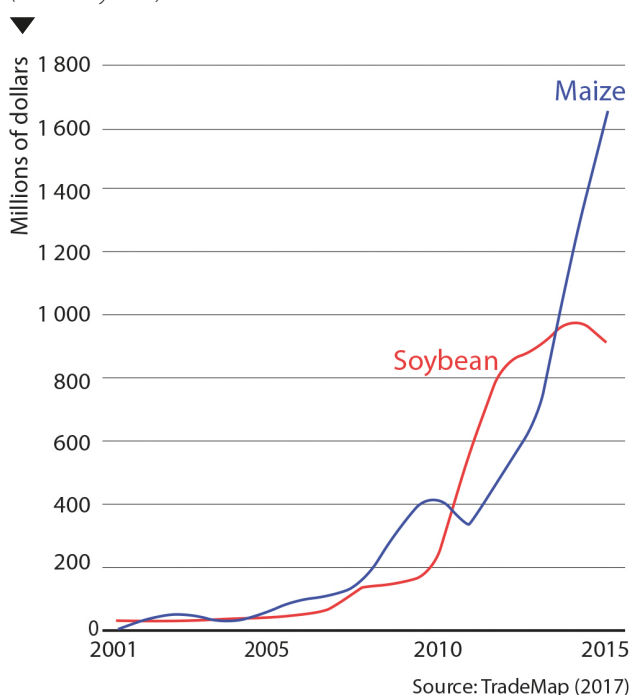
## Imports from the Americas

Brazil, Argentina and the United States together account for more than 95% of the value of agricultural raw materials imported for animal feed. For purposes of comparison, in 2015, Vietnam earned US\$2.2 billion from rice exports, while maize and soybean imports cost the country more than US\$2.5 billion. In value terms, the trade balance for cereals and protein crops has fallen into a deficit.

## The massive industrialization of animal feed

Overall, five companies manage the soybean and maize trade. By lowering its import duties, Vietnam is seeking to attract industrial investment and increase bulk volumes with the intent of becoming a regional player in industrial feed production in order to then re-export within the ASEAN market, or even to China.

Evolution of the value of agricultural raw material imports (maize/soybean) since 2000



Article from the Vietnam News on tax exemptions for animal feed

**BUSINESS**

**PM backs VAT exemption for animal feed**

**HÀ NỘI** — The Prime Minister is supporting the proposal of the Ministry of Finance to include animal feed in the list of products exempted from value added tax (VAT) payment.

The Prime Minister told the ministry to submit for review and approval the proposal at the 13th National Assembly due late this year.

A five per cent VAT rate is currently being imposed on animal feed. The proposed exemption aims to stabilise the price of feed in the domestic market and benefit the farmers, who have had to deal with diseases, declining consumption and other difficulties in breeding farm animals in recent years.

The farmers' situation further worsened following the increase in feed prices last year. The Department of Livestock Production attributed the increase to the country's dependence on imported raw materials for production and foreign producers' domination of the industry.

Animal feed is produced at Gungmarch V&M Nam. The finance ministry's proposal to include animal feed in the list of products exempted from value added tax (VAT) payment now has the Prime Minister's support. — VNA/VNS Photo Minh Dũng

Figures from the Ministry of Agriculture and Rural Development showed that Viet Nam has 58 animal feed producers with more than 200 feed production plants. Foreign animal feed producers make up one-third of the total and account for around 65 to 70 per cent of the market. According to Nguyen

Ding Vang, President of the Viet Nam Industry Association, a VAT exemption for animal feeds is good news for farmers, who expect the price of animal feed to fall.

To further boost breeding and aquaculture and ensure that Government support reaches the farmers, the Ministry of Finance has been asked to help the Ministry of Agriculture and Rural Development and other concerned authorities in tightening management of the pricing of imported and locally produced animal feed, as well as quality standards for and measures to protect local animal feed production.

Regarding tax policies on agricultural inputs such as fertilisers, pesticides and veterinary medicines, the Prime Minister ordered concerned ministries to formulate policies that conform with the Government's agricultural development and taxation system reform strategies for 2011-20. — VNS

# Emerging livestock feed industry

## Emergence of animal nutrition agro-industry

Since the 1990s, Vietnam has encouraged foreign investors to build industrial feed factories. The Thai company Charoen Pokphand (CP) started operating near Ho Chi Minh City in 1988. In approximately 20 years, the company created a network of about one dozen factories. In 1991, Proconco, then a Franco-Vietnamese company, set up operations in the port of Biên Hòa, 10 km north of Ho Chi Minh City, and then in the port of Hải Phòng in the north of the country. In 1995, after economic agreements between the United States and Vietnam were signed, the American company Cargill also set up shop in Biên Hòa. It extended its distribution network into the south of the country, followed by the north and center. In 2009, the country had 260 companies specialized in animal feed. The top 17 companies accounted for 73% of production. Only one company in the “top 10” was Vietnamese.

*Feed factory on the road between Hải Phòng and Hanoi*



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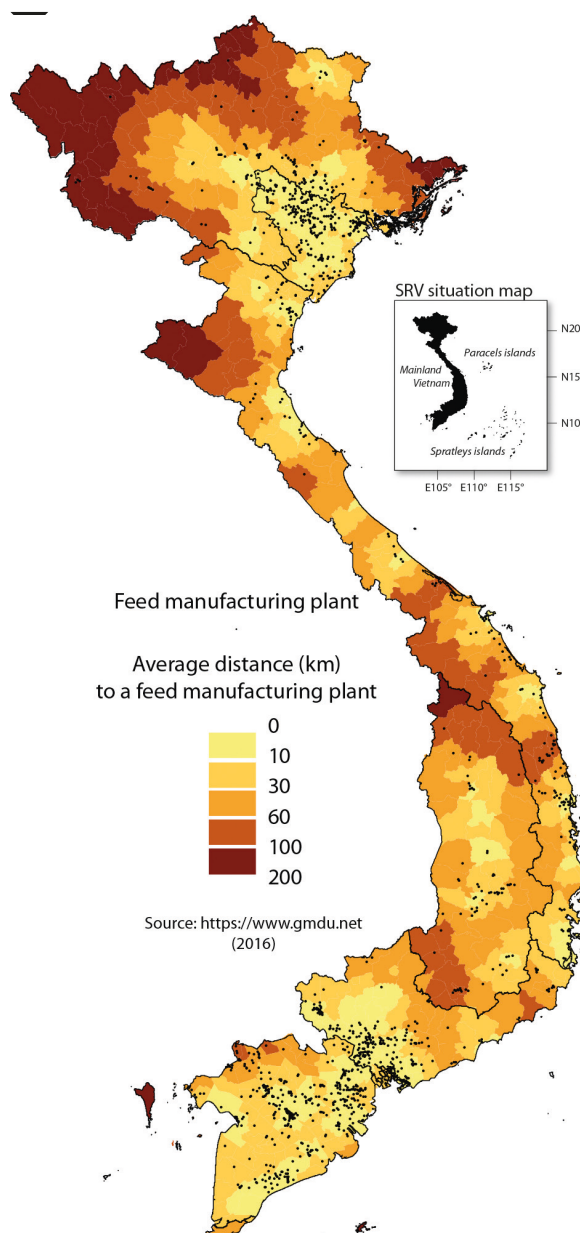
## A strategic but poorly described sector

The geography of livestock feed factories is poorly described. Various lists of livestock feed companies can be found on the internet. Some are detailed but dated, while others are incomplete but more recent. Using the best lists, it was possible to georeference some of the feed factories. It was difficult to determine the volume produced on each site. A specific study would be required to provide supplementary information on these agro-industries.

## The spatial spread of industrial feed

Based on the location of the country's 260 feed factories, it is possible to estimate the average distance to a feed production site for each district. The mapping of feed factories renders it possible to understand the spatial organization of the distribution of different livestock production systems. On the outskirts of Ho Chi Minh City and in the Red River Delta, there is at least one feed factory within 10 km. In the center of the country and along the borders, average distances to reach a feed factory exceed 100 km. The use of industrial feed in livestock production is lower in these areas than elsewhere in the country.

*Distribution of feed factories and average distance per district in 2014*



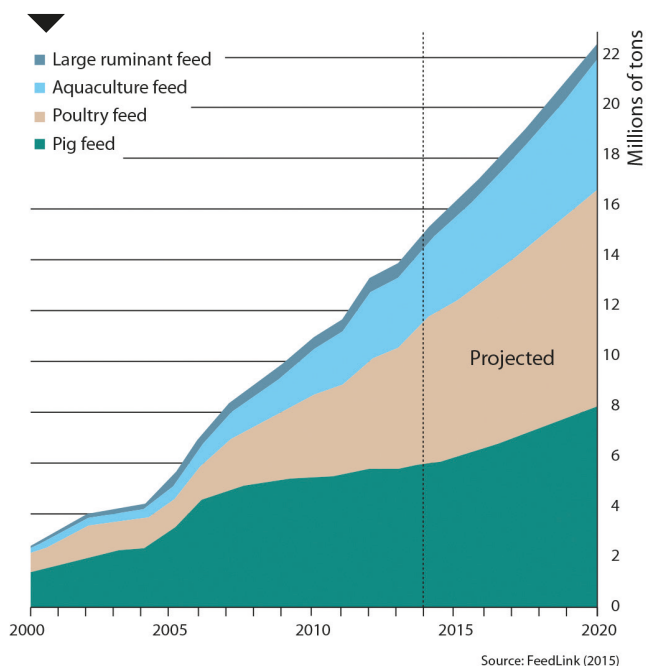
*Industrial feed on a farm in Mai Sơn*



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Evolution of industrial feed production by type of species since 2000



### Pig feed, the starting point of industrialization

Until only recently, industrial animal feed was mainly intended for pig farming. In 2007, about 60% of the volume of feed produced by agro-industries went to pig farms. In 2015, pig feed only represented 37% of the total. The volume of pig feed in effect did not increase much between 2007 and 2015, rising from 5 to 6 million tons.

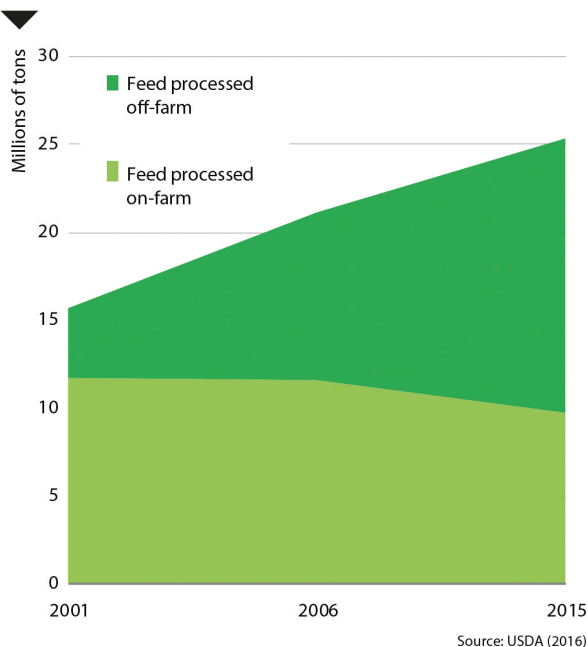
### Poultry farming well positioned for the future

In contrast, the volume intended for poultry farming increased from 2 to 6 million tons between 2007 and 2015 and is now on par with the pork sector. The aquaculture sector also is growing rapidly but remains in second place in terms of volume. Estimations by species shows a resumption of growth in the pork sector after 2015. Even if this recovery takes place, in terms of volume, the pig sector will be overtaken by poultry by 2020.

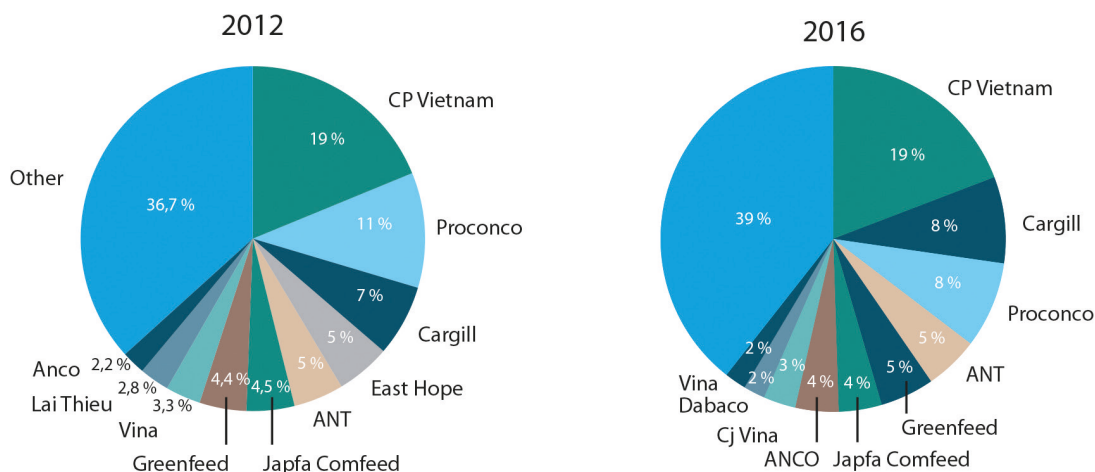
### The growing dependence of livestock systems

According to the U.S. Department of Agriculture (USDA), in 2015, Vietnam produced about 13 million tons of agricultural raw materials for livestock. 5.3 million came from maize crops, 5 million from rice crops. Moreover, there were 500,000 tons of broken rice and 1 million tons of cassava. However, the demand was for over 25 million tons of raw material. The country consequently imported 12 million tons of raw material, mainly soybeans (5.2 million tons) and maize (2.9 million tons). Other commodities such as wheat, livestock by-products and additional components (animal meat and bonemeal, fishmeal) accounted for almost 1.8 million tons. This highly dynamic market has already changed considerably. Farms have become very dependent on industrial feed. Indeed, according to the USDA, the penetration rate of industrial feed in animal nutrition has increased from 21% in 2001 to 65% in 2015. This average hides a wide variety of penetration rates under various livestock farming systems.

Average change in volume of feed processed on and off livestock farms since 2001



Comparison of the market share of the main livestock feed companies in Vietnam between 2012 and 2016



## Deforestation and animal feed: how are they linked?

### Deforestation in Vietnam: abandoned for half a century

Vietnam has long been known for its rapid deforestation. Between 1950 and 2000, the country's forest cover rate dropped from 40% to under 10%. Logging and agriculture have been the two main drivers of this loss of forest cover. Under the Đổi mới reforms, small farmers could cultivate the land on forest slopes. In the center, coffee trees have replaced wooded areas, while in the north, smallholders are growing maize and cassava instead. The latter two crops, which are used for animal feed, are helping to reduce reliance on imports, and explain why feed factories are located near mountain areas. However, these annual crops raise several environmental questions because they lead to substantial soil erosion when land is put under cultivation.

### Cattle feed and agro-forestry: is there a potential?

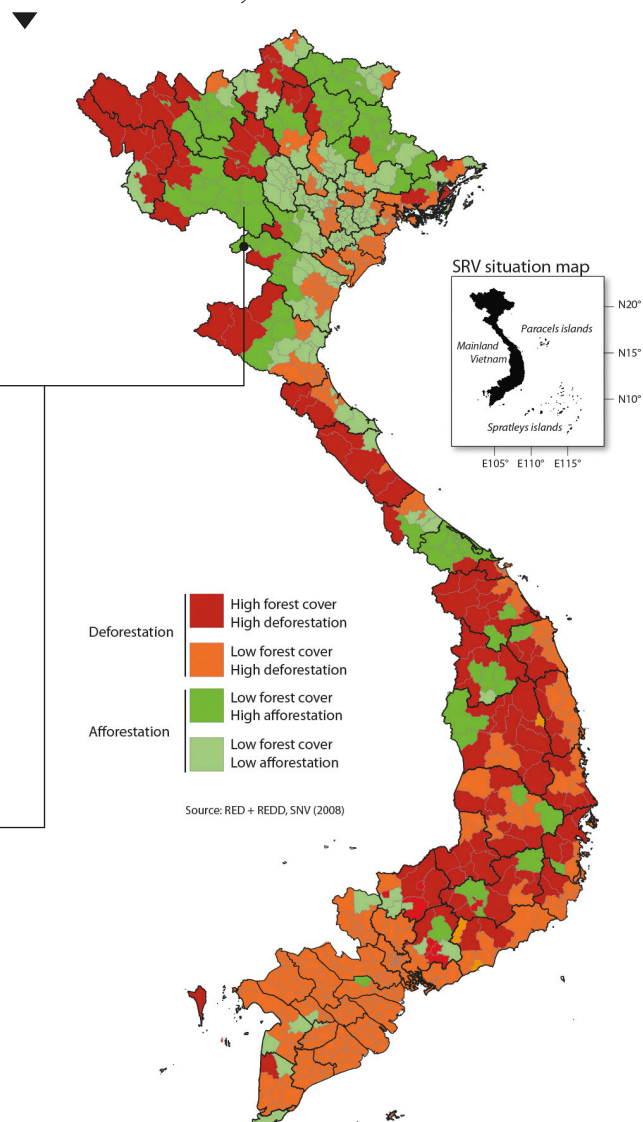
How can one reconcile annual crops cultivated on sloping land with the protection of resources and soils? Conservation agriculture and landscaping, such as *Sloping Agricultural Land Technology (SALT)*, seem to be potential ways to address the multiple needs of production and resource conservation. However, the government is implementing a new reforestation policy with a higher level of protection for mountain slopes. In some districts, hundreds of smallholders lost access to land when slopes were put under protection. This loss of cereal and tuber production is compensated in the plains by the introduction of high-yield GM crops and maize imports, which are less expensive than the maize produced in the highlands. Grass-fed ruminant farming is gradually developing with the return of the forest.

Advertising for hybrid maize seeds in the province of Sơn La

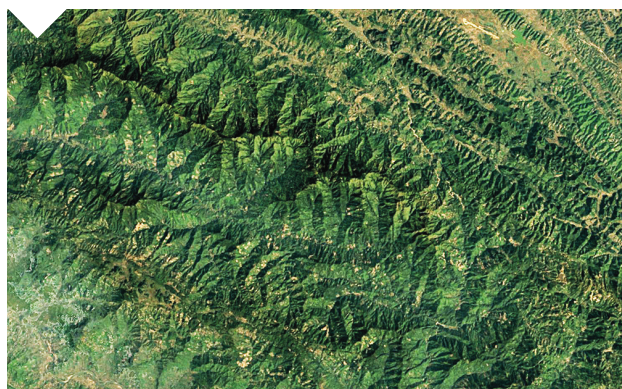


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Evolution of forest cover by district between 1998 and 2008

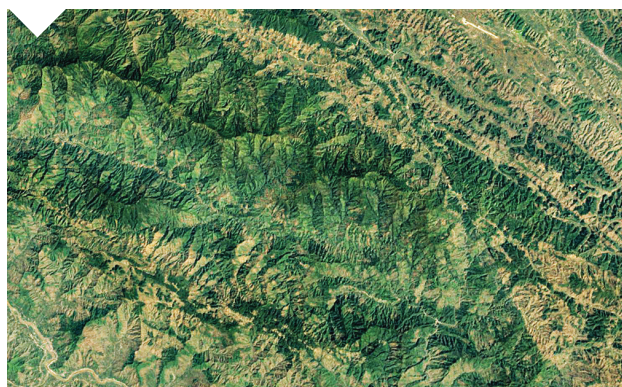


Forest cover in Sơn La in December 1995



© Landsat (Dec. 1995)

Forest cover in Sơn La in December 2015



© Landsat (Dec. 2015)



# Chapter 4

## The sustainability of pig production

*J.-D. Cesaro, D. Sautier, Nguyen Manh Cuong, I. Baltenweck, Tran Doc Lap, Le Thi Thanh Huyen*



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*Intensive pig farm amidst rice fields in Hòa Bình*

# Small family farms dropping out of the picture

## Family pig farming: a disappearing tradition

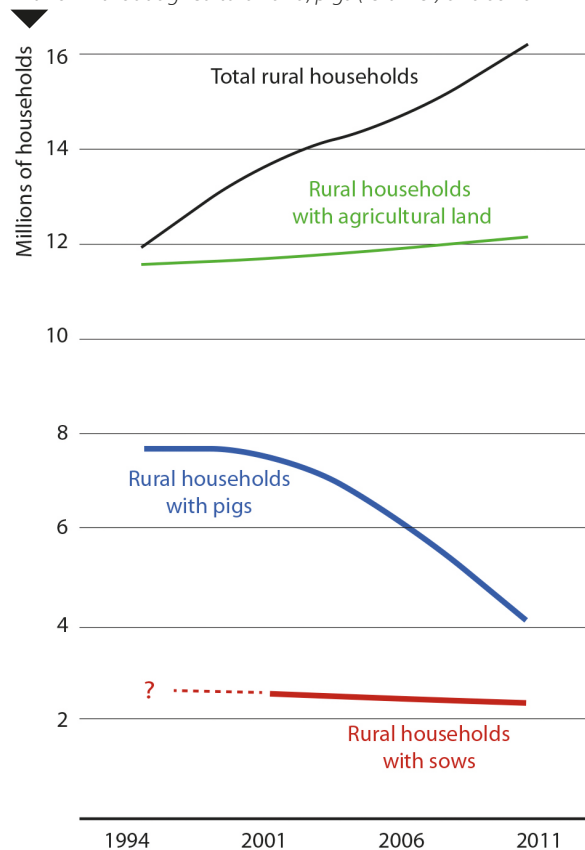
For a long time, pig farming was an essential activity for rural households. Up until the early 2000s, a family of four lived on an average income of US\$750 per year. In general, one quarter of this income came from pig farming. In 2001, over 7 million households had at least one pig. Pig production was one of the economic pillars of farm sustainability. However, as the economy developed, other sources of revenue began to compete with this activity. In 2010, pig production accounted for only 15% of the income of the 4 million rural households which continued to engage in this activity.

Local pigs on a family farm near Hanoi



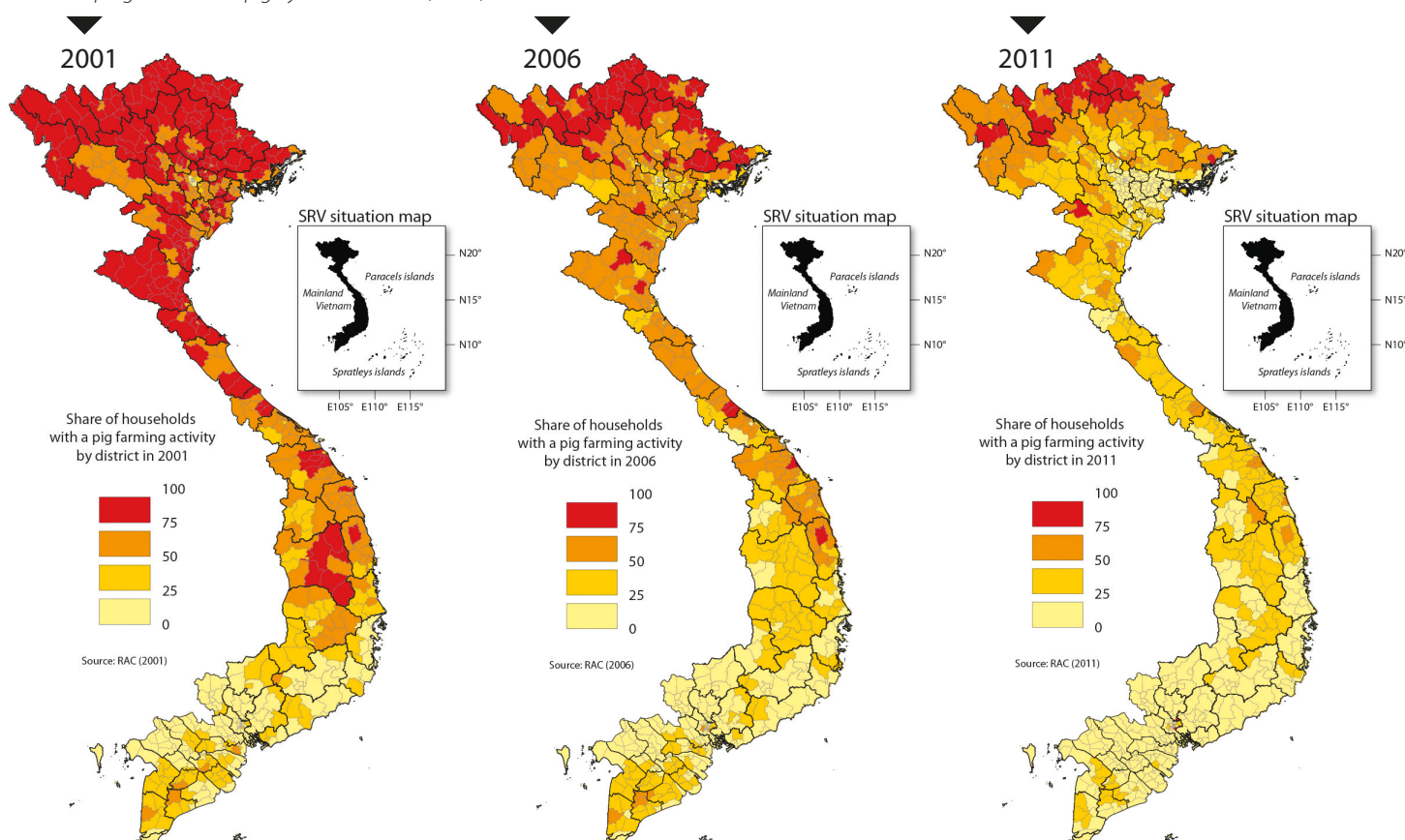
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Evolution of the number of rural households with or without agricultural land, pigs (fertilizer) and sows



Source: RAC (1994, 2001, 2006, 2011)

Evolution of the share of rural households keeping at least one pig by district in 2001, 2006, and 2011





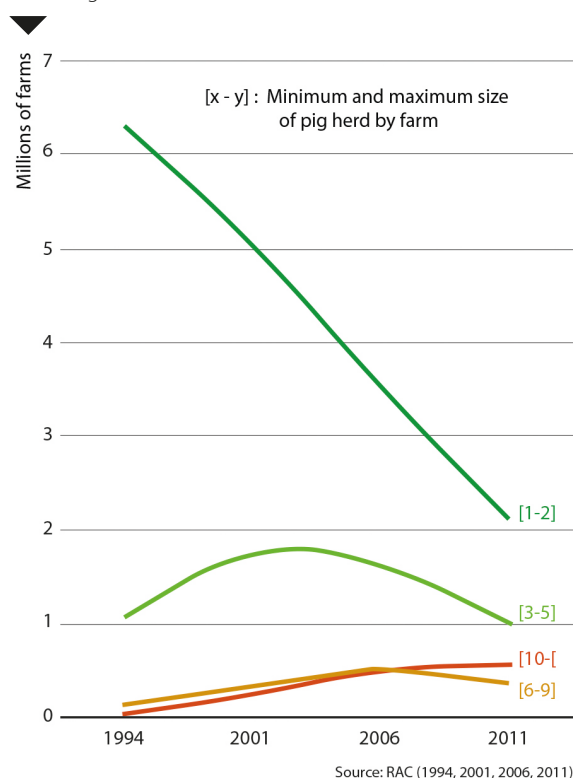
## The collapse of family pig farming

Between 2001 and 2011, the number of farms engaged in pig production dropped from 7 million to 4 million. During the same period, the number of rural households grew from 13 million to over 16 million. In other words, in the space of ten years, the share of rural household with at least one pig dropped from 53% to less than 25%. This collapse must be studied in detail because it reflects a profound restructuring of pig production.

## Small specialized farms on the decline

The number of farms with 1 to 3 pigs fell from 6.3 million to almost 2.1 million between 1994 and 2011. This drop was continuous for nearly twenty years. At the same time, the number of farms with 3 to 5 pigs increased between 1994 and 2001, only to fall since 2006. Farms with 6 to 9 pigs increased up to 2006 and then their numbers began to drop. Only farms with more than 10 pigs have continued to increase in number. However, it is highly likely that in 2016 this category also was on the decline. All analyses converge in pointing to a rapid disappearance of the smallest farms.

Evolution of the number of rural households with pigs according to the size of the herd on the farm



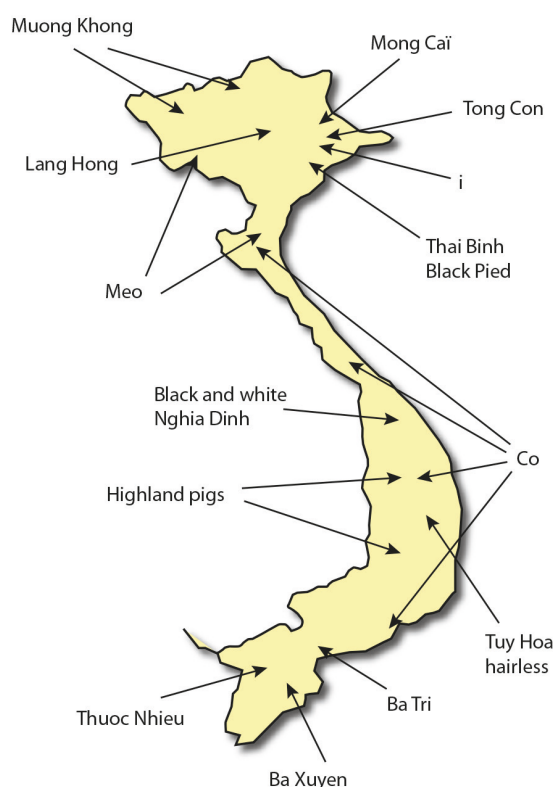
## The north-south gradient of pig production

Pig farming is distributed along a strong north-south gradient. The districts with the largest share of households engaged in pig farming are in the north, while districts in the south have relatively low participation rates compared to the rest of the country. One also may observe a coast-mountain gradient. In the Red River Delta, the share of households with pigs is lower than in highland regions. This distribution corresponds fairly well with the distribution of the economic poverty rate in the country. Indeed, economic poverty is associated with a subsistence and self-sufficient economy. The gradual disappearance of districts with more than 75% of households raising pigs may be a sign of the general economic development of the country as well as the specialization of households.

## Is the genetic diversity of Vietnamese pigs at risk?

The collapse of family farms raises questions about the survival of pig genetic diversity in Vietnam. The development of more intensive farms is leading to less productive breeds being set aside in favour of exotic ones. According to Molénat and Tran The Thong (1991), pig genetic diversity in Vietnam relies on local diversity and crossbreeding with exotic breeds. This diversity is first a matter of geography. Diversity is greater in the highlands than in the lowlands. Hardy breeds are more easily maintained in inaccessible valleys than in the plains. Centuries of breeding and crossbreeding have created productive breeds. Today, crossbreeding is increasing in more accessible areas as well as in the mountains. The disappearance of millions of small pig units carries a risk of genetic diversity loss.

Map of local pig breeds in 1994

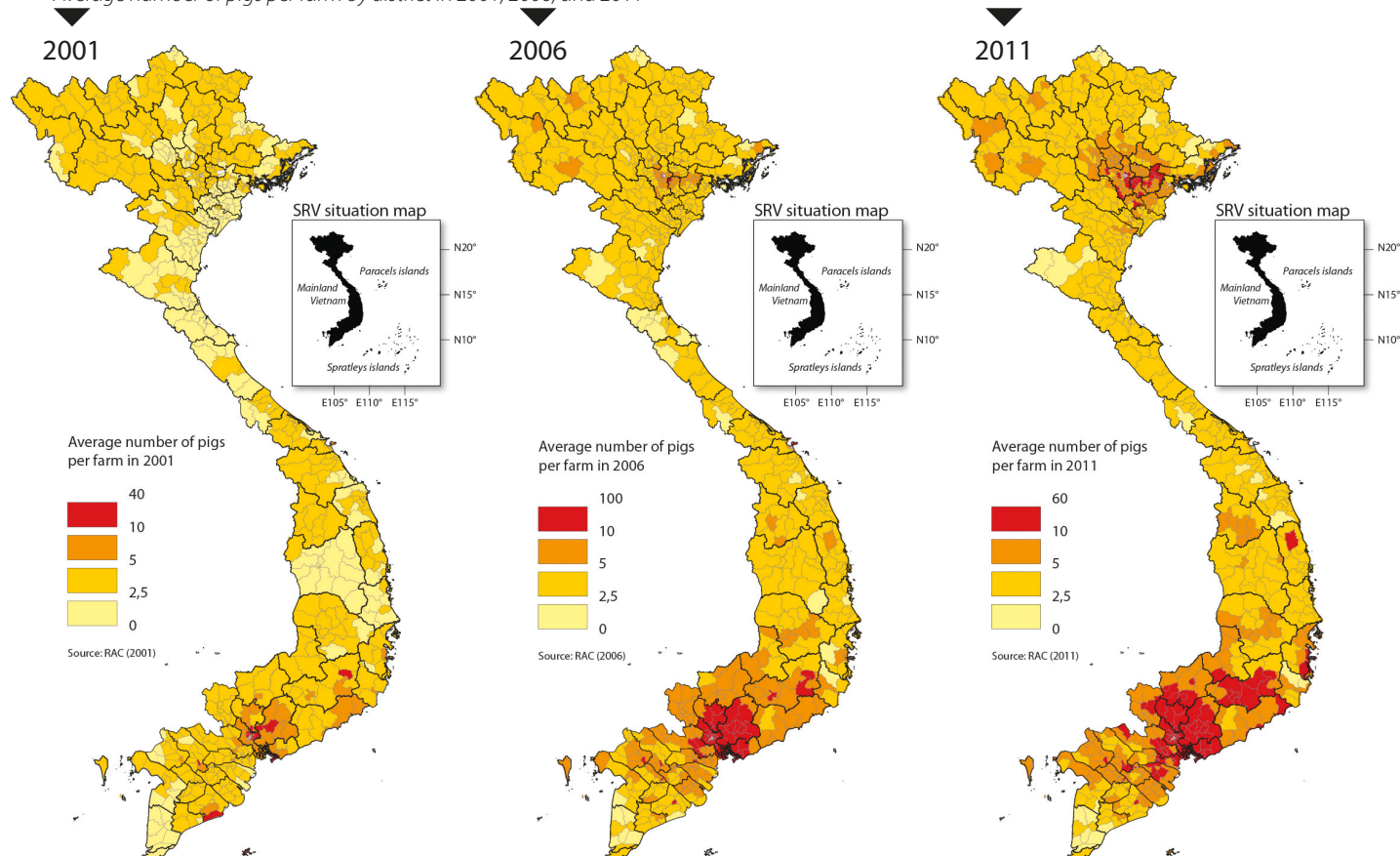


Transporting a pig in Đồng Văn



# Concentration and specialization of livestock production

Average number of pigs per farm by district in 2001, 2006, and 2011



## The restructuring of the sector

To understand the restructuring of pig production, farms and livestock were divided into groups according to herd size. The categories were: 1 to 9 pigs, 10 to 49, 50 to 99, 100 to 499, and 500 pigs or more. In 2001, farms with 1 or 2 pigs represented 99% of farms and accounted for 75% of production. In 2011, the categories 1-9 and 10-49 pigs represented 99% of the country's farms. The remainder represented barely 50,000 farms. However, this 1% of farms accounted for more than 15% of production. In 2011, farms with more than 10 pigs held over 50% of the national herd. This concentration has boosted medium-sized farms, but large farms (over 100 pigs a year) are gaining ground.

## The north-south pig concentration gradient

The evolution of pig concentration by farm shows a clear difference between the north and south of Vietnam. The Southeast region stands out from the rest of the country. The districts north-east of Ho Chi Minh City displayed average pig concentrations of over 10 pigs per farm as early as 2006, while in the Red River Delta, and particularly around Hanoi, the average concentration varies between 5 and 10 pigs by farm. In 2011, the districts on the Hanoi -- Hải Phòng axis had a concentration twice as high than the rest of the Red River Delta. In the south, the concentration also has increased. A group of more intensive districts appears to the south of the Highlands region. This development is marked by an increase in densities, but especially by the disappearance of small family farms. Only large farms are resisting changes induced by developments in markets and public policies.

## Total pig density by farm type

Thanks to the analysis of the contribution of farm types to total pig densities per district, it is possible to identify the locations favoured by certain types of farms. Between 2001 and 2011, the pig density of small farms decreased while there was a net increase in pig densities linked to medium-sized farms. Large farms primarily developed in well-connected regions. Mountain regions retained a more traditional production structure.

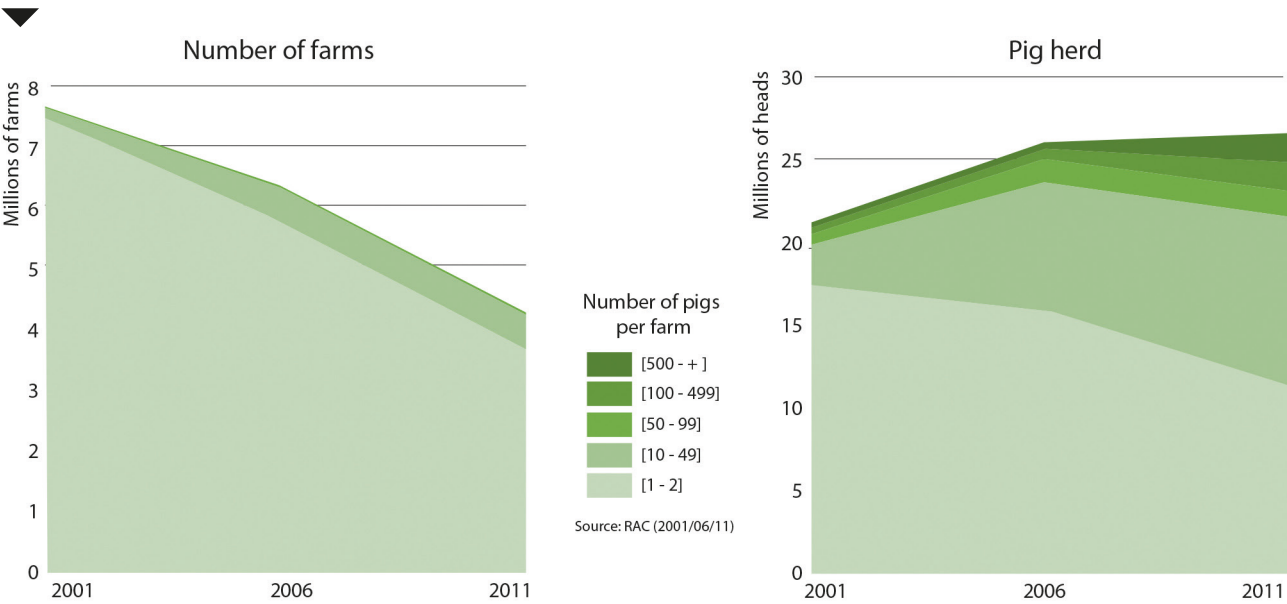
Commercial farm in the province of Đồng Nai



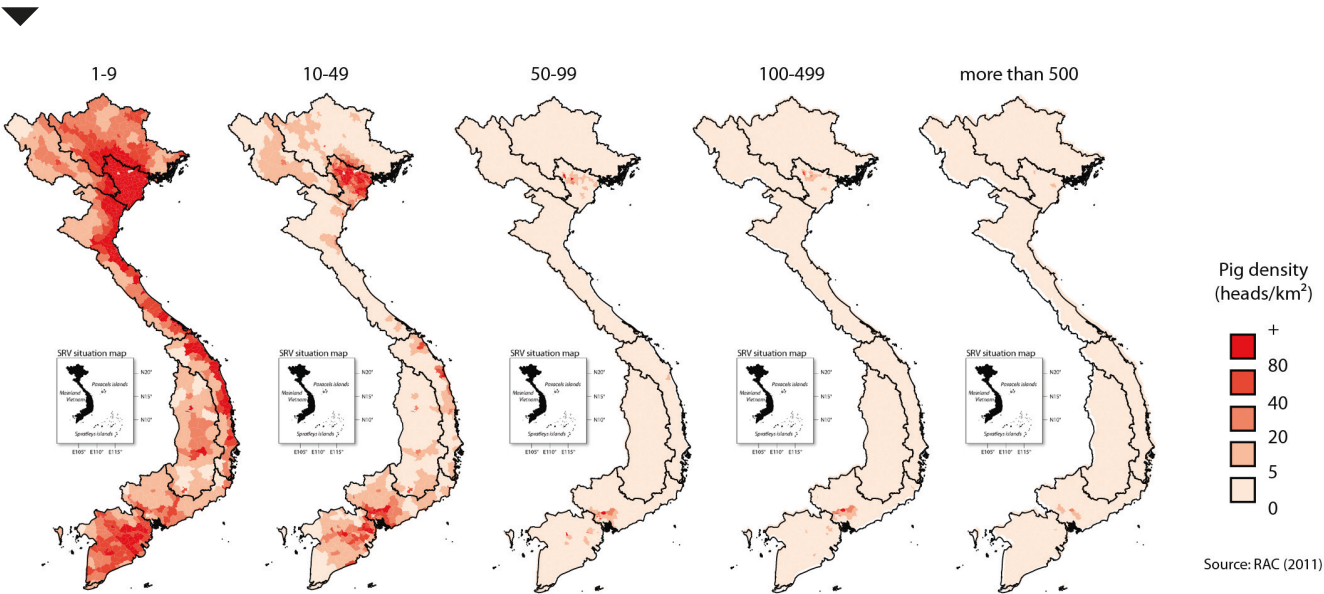
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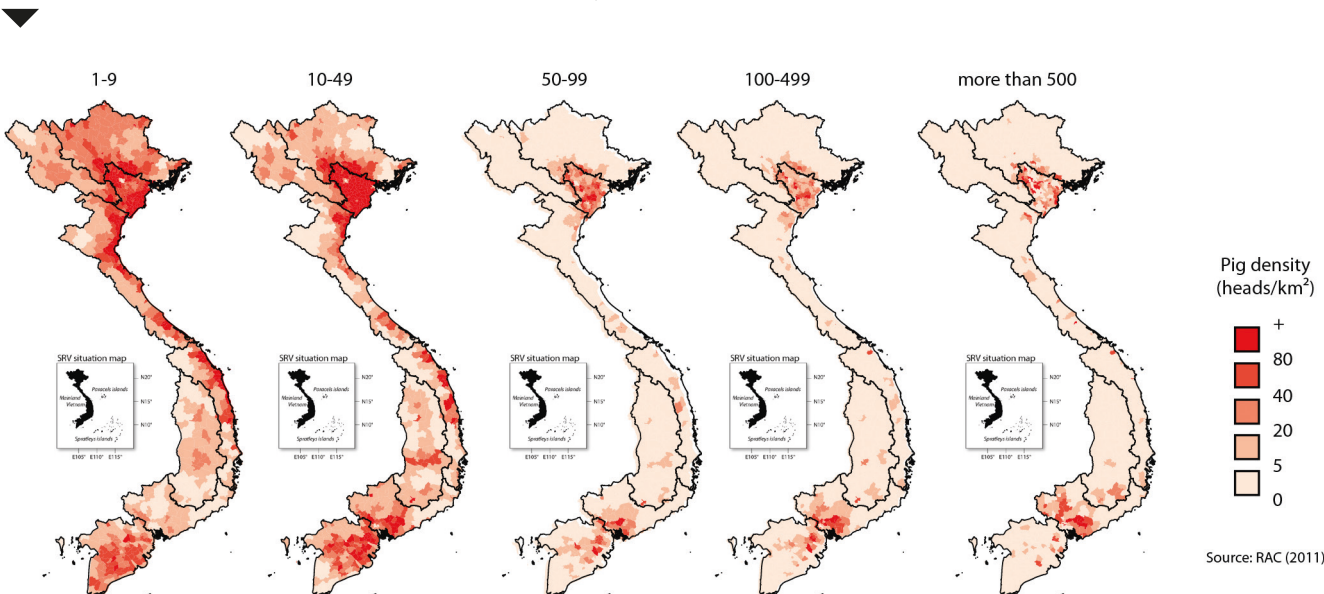
Evolution of the number of farms with pigs according to herd size between 2001 and 2011



Contribution of different pig farm categories to the total pig density per district in 2001

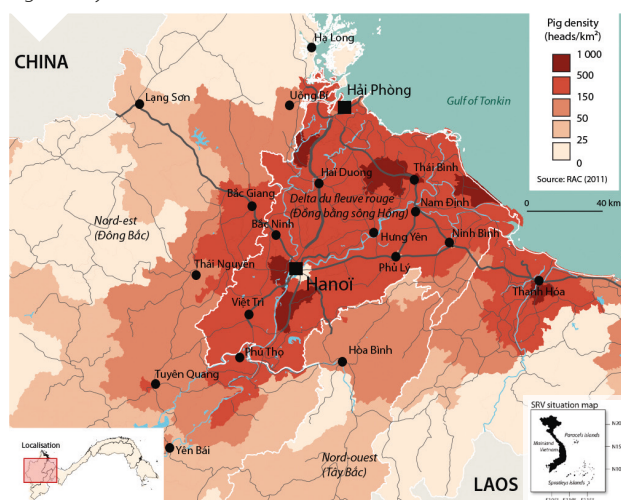


Contribution of different pig farm categories to the total pig density per district in 2011

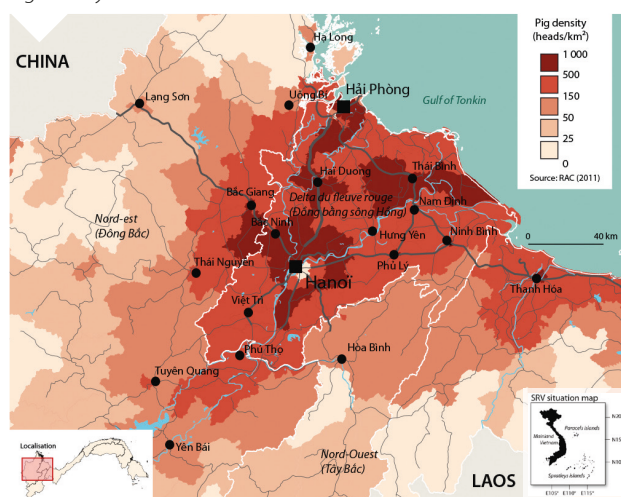


# Relocation of pig production away from large cities

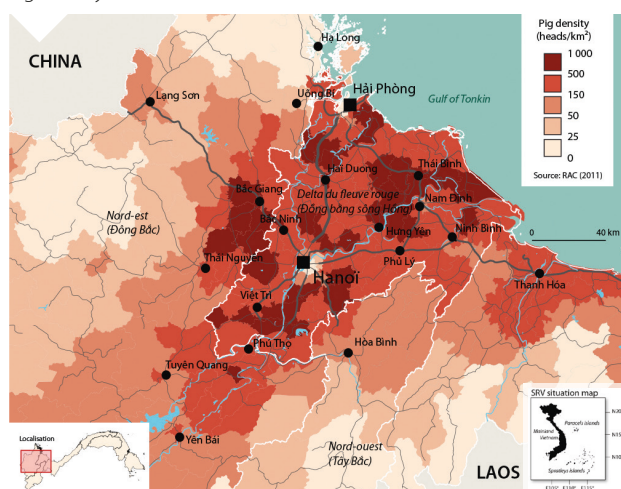
Pig density around Hanoi in 2001



Pig density around Hanoi in 2006



Pig density around Hanoi in 2011



## The push and pull of large cities

To better understand the spatial dynamics of the redistribution of pig production in a context of restructuring, one needs to look at the outskirts of major cities such as Hanoi and Ho Chi Minh City. As a reminder, these two cities alone hold about 10 million inhabitants, 7.4 million in Ho Chi Minh City and 2.6 million in Hanoi. The markets in these cities continue to have a polarizing effect on commercial breeding activities and were at the core of the transformation of the geography of pig farming during the 2000s.

## The Red River Delta and its densities

The force of attraction on the farms was noticeable around Hanoi in the early 2000s. The majority of communes with pig densities higher than 500 heads per hectare were found within a 20-kilometre radius of the city. Likewise, numerous communes within 20 kilometres of Hải Phòng reached similar densities. In the peri-urban countryside, pig production is considered to be an income-generating activity that allows rural people to connect to the development dynamics emanating from cities.

## Development corridors

The regions along the major transport routes initially benefited because feed imports from Hải Phòng encouraged the establishment of agro-industrial factories along the national highway between the capital and the port. In areas where agro-industrial factories were set up, the density exceeded 500 pigs/km<sup>2</sup>.

## Towards the end of the pig belt

Between 2006 and 2011, the high densities around Hanoi began to erode under the weight of urbanization. The extension of the province of Hanoi in 2008 offered the city land for rapid urbanization. The farming communities living near the capital opted for other sources of income than livestock production. In peri-urban areas, livestock farming was indeed less profitable than secondary or tertiary sector activities, and was above all a source of pollution, which led public authorities to limit the activity.

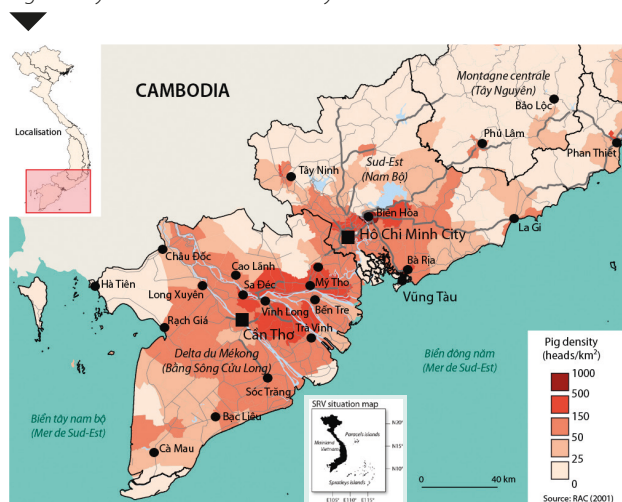
Local pigs in the province of Hanoi



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Pig density around Ho Chi Minh City in 2001



## Ho Chi Minh City and the Mekong Delta

The country's leading economic metropolis, Ho Chi Minh City, lies at the convergence of two regions: the central highlands to the north, and the Mekong Delta to the south. The city also is at the crossroads between Cambodia and the port of Vũng Tàu, the country's deep-sea port. In the Southeast region, human population densities are considerably lower than in the Red River Delta. Nevertheless, they exceed 450 hab/km<sup>2</sup>. Traditionally, southerners consumed relatively more aquaculture products. However, since the 1990s, meat production has been expanding.

## The historic region of the Lower Mekong

In 2001, high pig densities primarily were found in the Mekong Delta. This location was due to the river transport of raw materials. Cambodia and Mekong rice farmers sold their rice to intermediaries who transported the grains to the ports of Cần Thơ and Vĩnh Long. By-products of rice processing were then mixed into animal feed. Pig densities in the eastern part of the Mekong Delta were then over 50 pigs per km<sup>2</sup>.

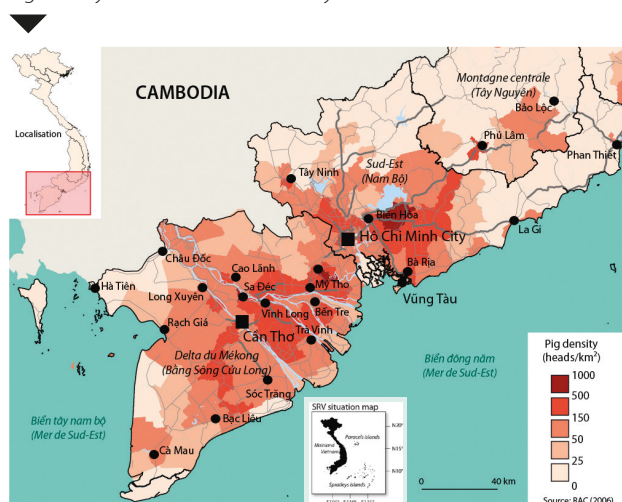
## The spectacular development of the Southeast region

However, one must note the existence of high densities to the north of Ho Chi Minh City in the region known as the Southeast. Along the main axes of communication, several communes have over 500 pigs per km<sup>2</sup>. The process of industrialization had already begun in the early 2000s. From 2011, densities increased in the Ho Chi Minh City - Biên Hòa - Vũng Tàu triangle and around Mỹ Tho. The highest densities are located outside the 50 km limit around the capital. What are the consequences from an environmental perspective?

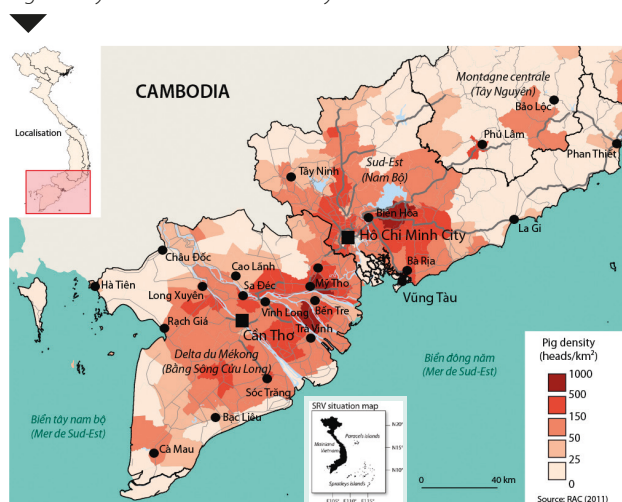
## Does concentration pose risks?

The emergence of high densities in the south of the country is linked to the restructuring of production. However, the densities in the south are technically lower than in the north, notably in the Red River Delta. Does this mean that there are higher environmental risks in the north than in the south? Survey data show that environmental problems are sharper in the south. In the north, livestock numbers are higher but farms are smaller, and therefore spread out in the environment. Crop and livestock farming are more closely integrated, which reduces environmental risks.

Pig density around Ho Chi Minh City in 2006



Pig density around Ho Chi Minh City in 2011



Local pigs in the province of Đồng Nai

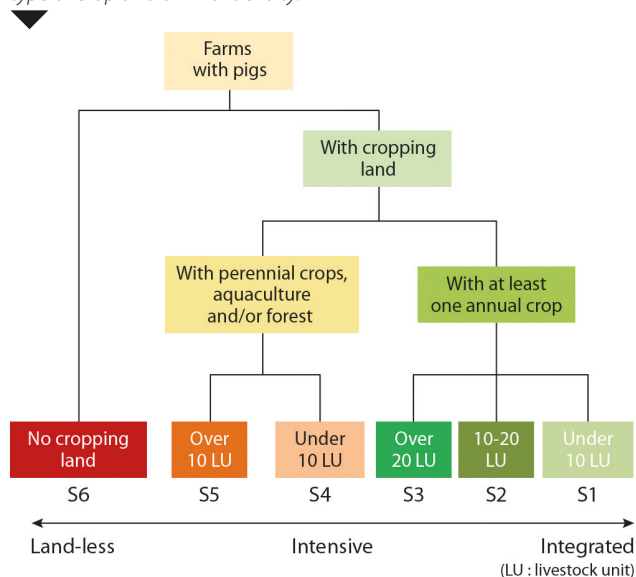


# Diversification of pig farming systems

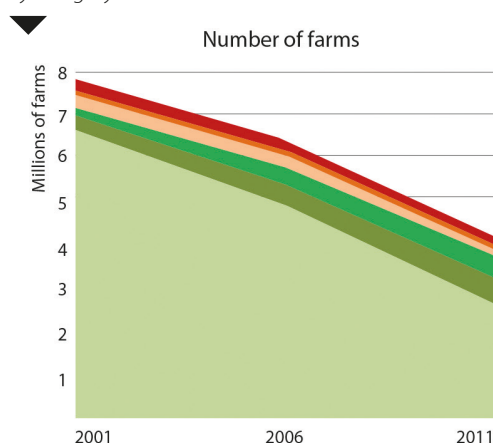
## Crop-livestock integration in Vietnam

What are the effects on the environment of the restructuring of pig production? What is the crop-livestock integration dynamic within farms? Is the development of commercial livestock farms and intensive family farms leading to a phenomenon of agricultural specialization of production systems? How can this transformation of systems be measured? Based on international typologies and farming systems approaches, we consider livestock farming activities in relation with the types of crops present on a farm. Using data from the agriculture censuses of Vietnam, we relate different livestock numbers to different crop farming areas. It is then possible to differentiate among pig farms, distinguishing those which have at least one annual crop (possible integration), those which only have perennial crops, and lastly those that have no farm land, and are thus no-cropping farming systems. Using these typologies, we defined six farm categories.

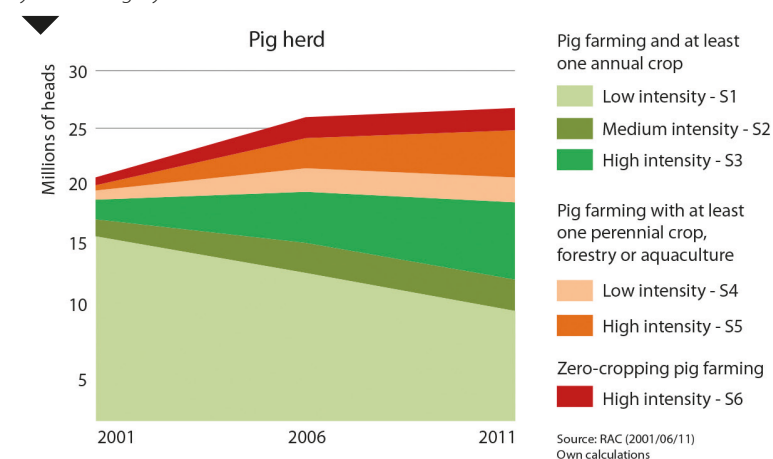
Pig farm categories according to the connection to the land, type of crop and animal density.



Evolution in the number of pig farms by category between 2001 and 2011



Evolution of pig production by farm category between 2001 and 2011



## Low intensity systems falling sharply

In 2001, pig farms were predominately in system category 1: presence of annual crops with low pig densities. They represented 90% of the farms and 80% of the herd. In 2011, these farms continued to represent 80% of the farms, but accounted for only 40% of production. They had dropped in number from 6.5 million to less than 3 million farms.

## Intensive systems picking up the slack

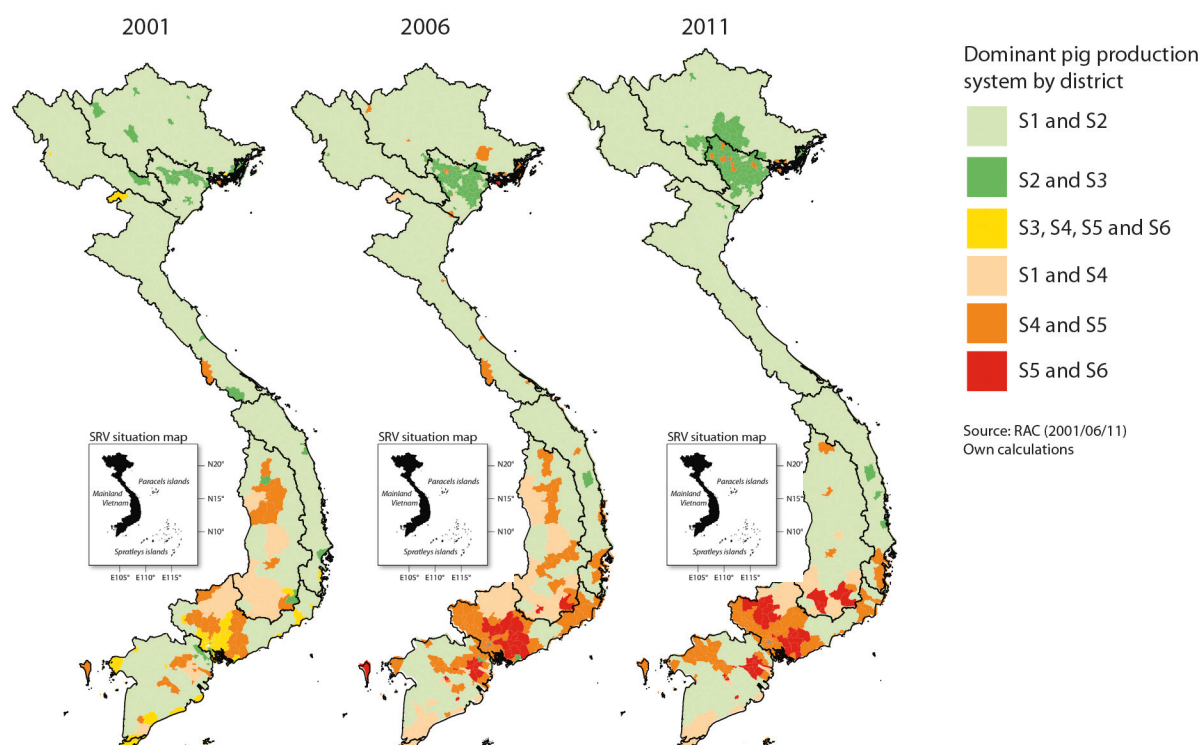
At the same time, more intensive livestock systems have grown in terms of production. Categories S3 (annual crops + high pig density) and S5 (perennial crops + high pig density) accounted in 2011 for 10% of farms and concentrated more than 25% of the national herd. There were approximately 400,000 S3 and S5 farms in 2011. Strictly no-cropping farming systems (S6), that is to say without farm land, are declining in number but are increasing slightly in numbers of pigs. The majority of these systems are located around cities for reasons related to economics (proximity to markets) and urban planning. In these areas, agricultural activities are disappearing under urban sprawl. These no-cropping pig farming systems could rapidly disappear.

A small pig farm and its management of effluents



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### The geography of crop-livestock integration

The intensive systems (S3 and S5) are overall overrepresented in the Red River Delta and the Southeast region. In 2001, the intensive systems were mostly located in the Southeast and were mainly integrated with perennial crops (S5). The majority of intensive annual crop systems (S2 and S3) were concentrated in the north along the Hanoi-Hải Phòng road where animal feed factories were established. The intensification in the north spreads out from transportation infrastructure across the region. In the south, one can observe the extension and relocation of intensive areas between 2006 and 2011.

### New models of pig production?

While this typology shows quantitatively the diversification of farming systems, it is fairly easy to observe these new forms of farming systems in the field. Since the early 1990s, the Vietnamese government has been supporting the development of VAC (*vườn - ao - chuồng*) farms, which consist of a small livestock production unit, a fish pond and a garden. Fluxes of nutrients between those 3 units (crops, residues, effluents, water) create a closed agro-ecological integration loop within the farm. This ideal model can take different forms. However, the farms often have gardens that are too small to manage the nutrient load of the pond water. The surplus is thrown into nearby rice fields. Likewise, the vegetable gardens are now giving way to cash crops with a high added value. These new crop-livestock integration models place an emphasis on arboriculture. Numerous Vietnamese livestock farmers use a large part of pig effluents to fertilize the trees (longan, mango, grapefruit, cashew nuts, rambutan, coffee). There are numerous possible combinations. Animal manure provides farmers with an effective fertilizer to adapt to changing market conditions. Demand for manure around pig farms is creating a local and regional market for organic fertilizers of animal origin.

### Widely diverse systems despite the restructuring

Beyond the classical analysis of the restructuring of pig production based on herd size, a livestock farming systems approach makes it possible to describe a process of diversification in pig production models rather than a process that is a priori one of homogenization. Indeed, the increase in the average herd size per farm is not a uniform pathway leading to the emergence across the country of the same forms of industrial livestock production. Rather the process is generating more models than there were originally. The integrated systems (S1, S2, S4) remain overall on the decline, and as 2030 approaches, some of these small pig farms could become less and less important.

Sacks of pig effluents in a perennial crop area



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# Is the development of landless farming systems safe?

## Multifactorial approach to livestock production risks

Several dimensions must be considered to fully grasp the environmental impact of livestock farming. Attention must be paid simultaneously to waste production, nutrient levels, and air, water and soil pollution. The effects on the health of human and animal populations also must be taken into account. However, the lack of official data and of reliable field data render it difficult to consider all of these dimensions. We therefore shall estimate the concentrations of the three main nutrients present in livestock waste (nitrogen N, phosphate P, and potassium K) at the farm and territory levels.

## Estimation and modelling of nutrient flows

The level of NPK nutrients in livestock manure has been widely studied around the world, which renders it possible to identify an average content per animal based on its weight and diet. Working from this estimation per animal, it is possible to estimate the level per farm. This content can be compared to the fertilizer requirements of plants per hectare, and thereby deduce the balance at different administrative scales: a volume of animal waste per farm is estimated and compared with the theoretical capacity for treating agricultural land. If the farm produces more waste than it has land, then the waste is not absorbed by the soil and consequently is a source of pollution. When this is the case, we compare the surplus of all of the pig farms with the agricultural land treatment capacity of farms without livestock units. If a waste surplus is observed at the scale of a commune, we redo the calculation at the district level and then at the province level.

Pig effluents released into the environment

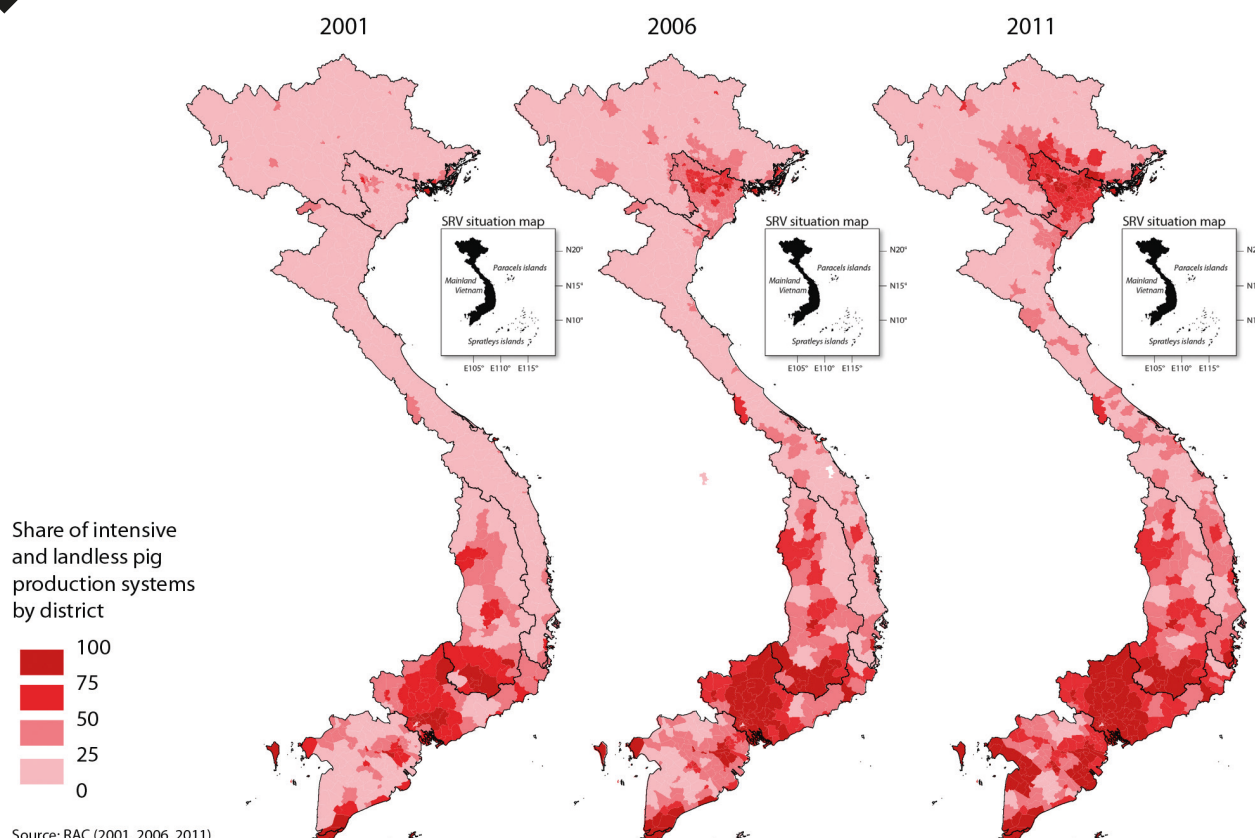


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## Regions dominated by intensive systems

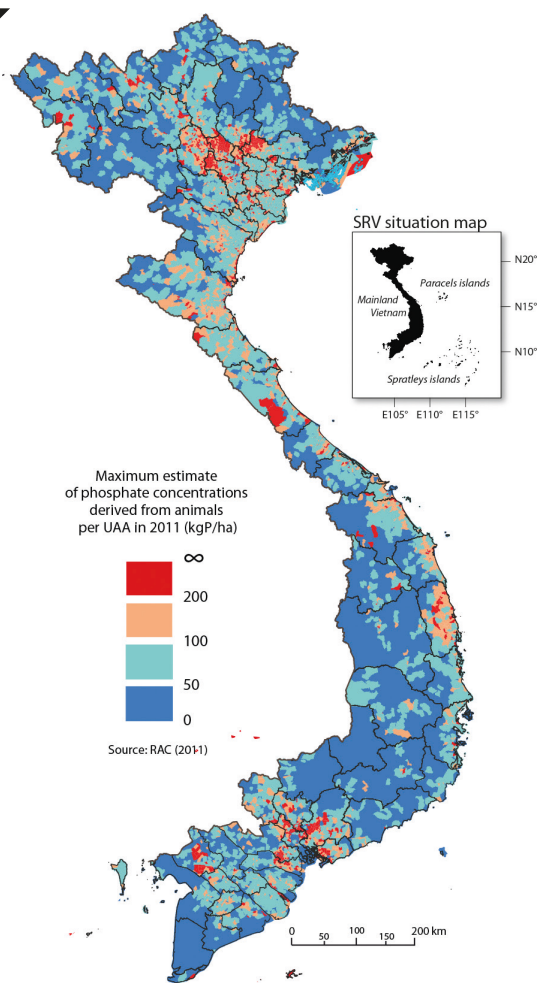
In both the north and south, intensive systems (S3, S4, S5 and S6) now account for over 75% of livestock in a growing number of districts. Mainly located around major cities, these intensive systems predominate in large agro-ecological regions such as the Southeast, the Red River Delta and the Mekong Delta. It seems that these intensive systems are spreading in the central and highland regions.

Share of intensive and landless systems in district output between 2001 and 2011.





Maximum estimate of the concentration of phosphate derived from animals per agricultural area in 2011



## Targeting environmental policy

On the basis of these data, the government could first focus on communes at high and very high risk and then on communes at lower risk. The vast majority of communes with surplus waste are on the outskirts of Ho Chi Minh City and in the Red River Delta. 120 communes have more than two times their phosphate requirements. The overwhelming majority of these communes are urban neighbourhoods with limited livestock production but also equally limited agricultural land. Of the top 10 surplus districts, nine are in the Southeast region. The top five are in the immediate vicinity of Ho Chi Minh City. Out of all of the districts with a surplus, only two can be considered to be “rural areas”. The risk at the district level is therefore more diluted by the presence of the agricultural land of communes with lower livestock densities.

## Technological response to risk in rural areas

In 2008, the government set up a zoning policy aiming to relocate intensive farms. The objective was to move intensive farms away from residential areas. The provinces of Đồng Nai (50 km from Ho Chi Minh City) and Hưng Yên (30 km from Hanoi) were the pilot sites for this experiment. In Đồng Nai, for example, the authorities defined “livestock concentration zones” (LCZ) in the district of Thong Nhat. The establishment of these zones was supported by the World Bank. The results obtained demonstrate that these livestock zones favour commercial livestock farms and increase livestock concentrations. Actual investments on the environment remain below what was expected.

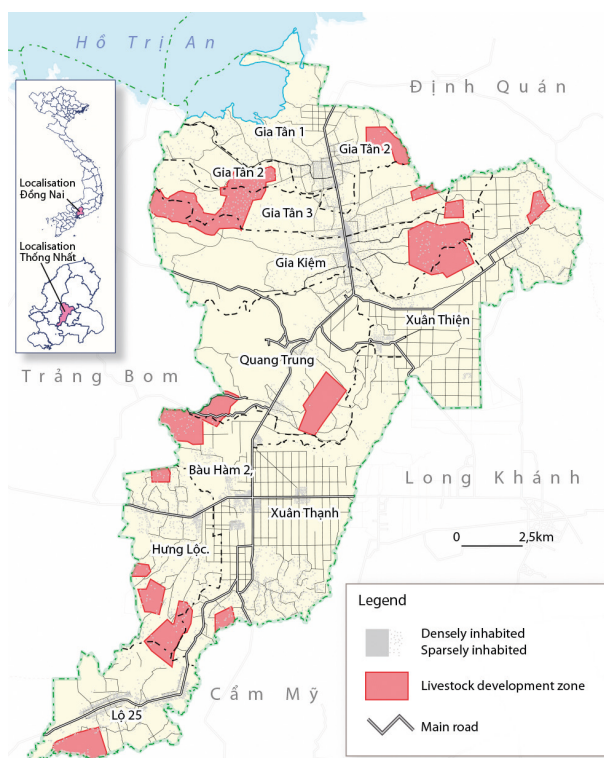
## From estimating concentrations to risks

It is possible to determine a level of environmental risk at the commune or district level from the estimated NPK balances per farm. For this, it is necessary to sum all the balances of the farms in the same commune or district and to compare them with the usable agricultural areas. The ratio obtained renders it possible to better grasp the surplus of effluents produced by livestock farming systems at the level of an administrative unit. There are four risk levels (low, medium, high and very high). If the effluent surplus does not exceed 50% of the agricultural requirements, then the saturation capacity has not been reached and the potential risk is low. Between 50 and 100% of requirements, the risk level is estimated to be medium. Beyond 100% for one nutrient (N or P or K), the risk level is considered to be high. When the levels of all of the nutrients exceed 100% of requirements, the situation is considered to be a very high risk. These calculations indicate that 1,000 communes have a high risk level, and 500 communes are facing a very high, if not alarming, risk.

## Undersized biogas systems



## Livestock concentration zones in Thống Nhất

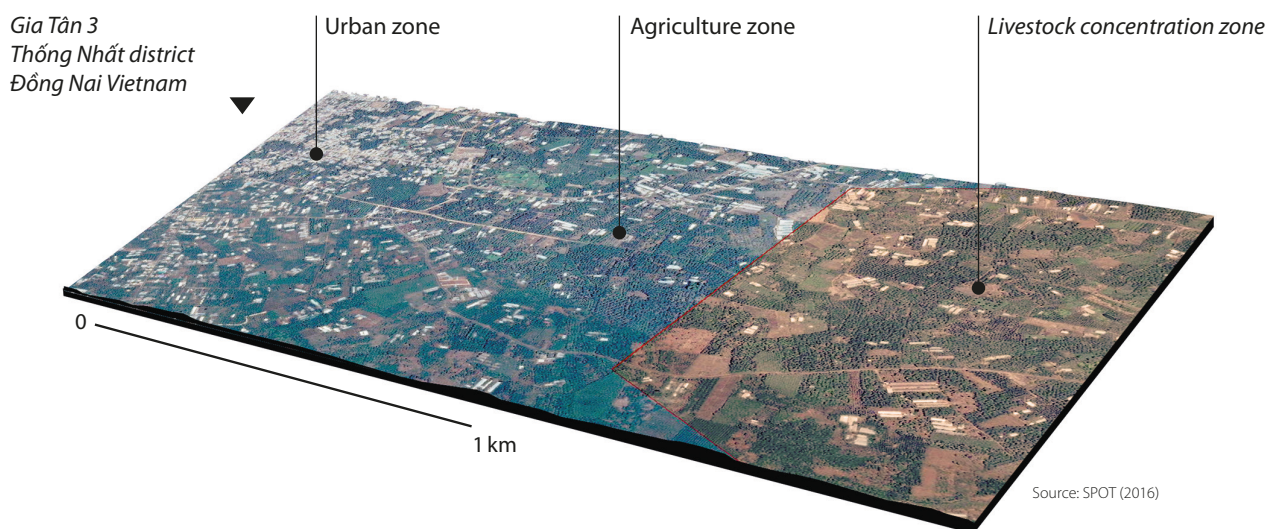


## Zoning and development of intensive livestock production

### “Livestock zones” well outside urban areas

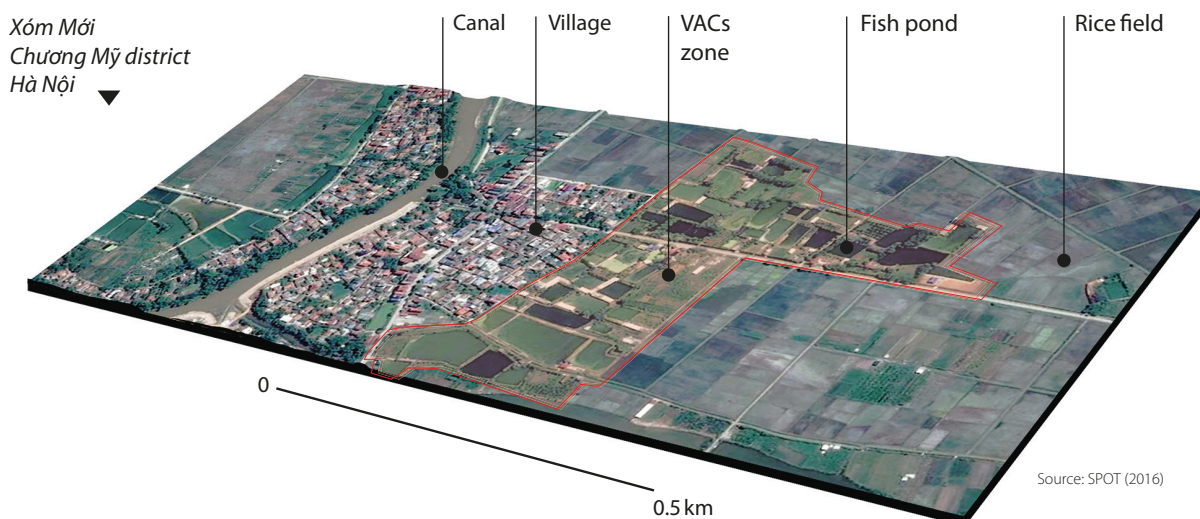
In the south of Vietnam, the establishment of “livestock concentration zones” (LCZ) is part of a process of intensification of livestock systems in a context of rapid urbanization. The extension of built-up areas has been made possible by the development of pig farming. In effect, it is possible to change the agricultural use of a plot of land if the farmer establishes a livestock unit on it. Between 2005 and 2015, the urban area tripled in size. At the same time, the number of pigs multiplied by five, generating heavy pollution of ground waters. This zone is furthermore located less than 2km from Tri An Lake, the primary water source for Ho Chi Minh City.

In the LCZs, local authorities are encouraging livestock farmers to themselves invest in road construction, treatment infrastructure and general development works. The State assumes the task of electrification up to the doors of commercial farms. In this part of Vietnam, the land market is open. The State has not managed to purchase land to develop these areas. The establishment of livestock zones has caused property prices to soar. The price of one hectare can exceed US\$50,000. Some are partnering with landowners to set up intensive livestock units. However, this race to concentrate is increasing environmental risks because the funds invested in buying land are unavailable for environmental management.



### Livestock production zones in contact with villages

In the north, the organization is different. The land belongs to the State. “Livestock concentration zones” also were established, and farmers interested in having a location in these zones register on official lists with commune authorities. User rights and investments are managed between the beneficiary and the local authorities. Due to a lack of space, livestock zones are adjacent to villages, which then serve as water treatment areas thanks to the fishponds. The VAC model (pig production + fishpond) prevails. The water is then used for the rice paddies.





# Chapter 5

## Dairy farming, a clash of production models

*Nguyen Mai Huong, Pham Duy Khanh, N. Hostiou, S. Cournut, G. Duteurtre, C. Culas, E. Pannier*



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*Model farm at the Ba Vi research center*

# The emergence of localized milk-sheds

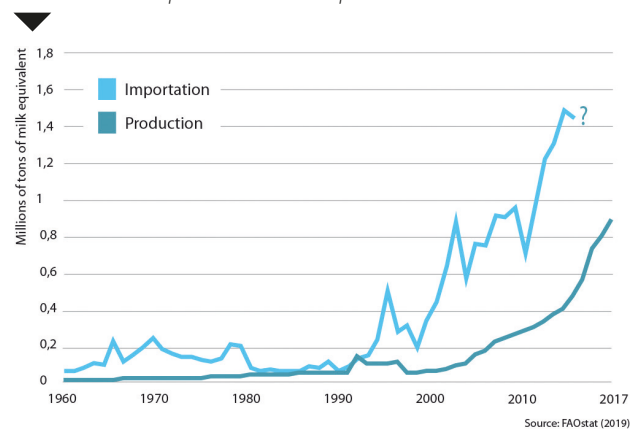
## Milk imports continue to dominate

The consumption of dairy products in Vietnam is expanding rapidly. Since 1990, the emergence of new eating habits and the increased standard of living of households have led to a rise in per capita consumption. Between 1990 and 2011, the amount of milk consumed annually per inhabitant increased from 1.4kg to 16kg. Up until the early 2000s, this growing demand was satisfied by a massive reliance on imports. While imports were under 100,000 tons of milk equivalent in the 1980s, they reached 1.4 million tons in 2011. It was not until 2002 that domestic milk production began to increase significantly thanks to the launch of a national dairy development program based on support for small farms. The reliance on imports came under intense scrutiny beginning in October 2008 when Vietnam was hit by a food crisis involving milk powder produced in China. This crisis led industrialists to take a renewed interest in collecting local milk.

## Emerging output

In the early 1990s, the country had less than 10,000 dairy cows distributed across a dozen state farms. In 2000, Vietnam had 44,000 dairy cows on 10,000 farms. By 2011, the country had slightly more than 130,000 heads spread over 37,000 farms. Over this entire period, the growth in production was supported by a strong demand for dairy products and joint investments from the government, business, agricultural households and development projects. These investments were focused on small farms in a limited number of districts that became milk-sheds where family farming dominates.

Evolution of milk production and imports in Vietnam since 1960

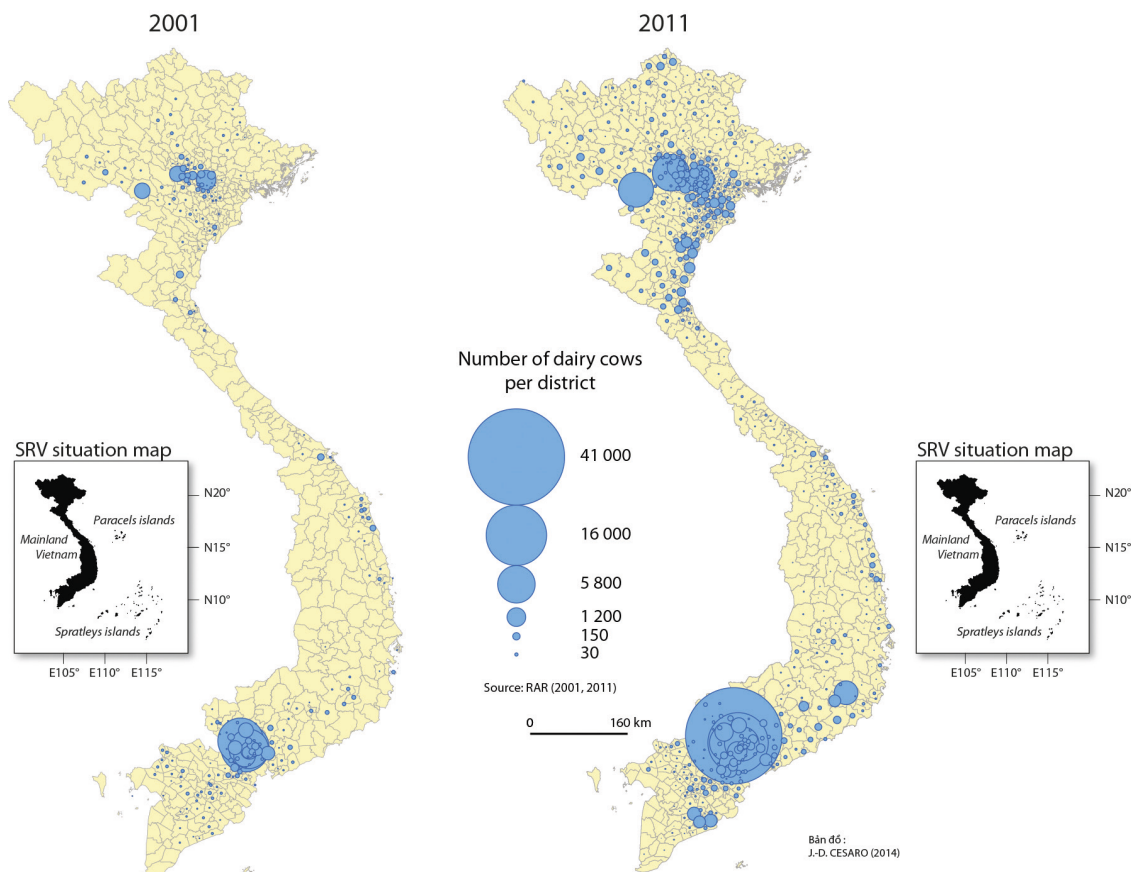


A dairy farm in Ba Vi



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Comparison of numbers of dairy cows by district in 2001 and 2011





## Traditional production areas

In the regions of Mộc Châu, Ba Vì, Đà Lạt and Củ Chi, the small family farm model was developed with real political will on the part of the government. Farms are generally small, with 3 to 4 dairy cows, except for Củ Chi, where farms have on average more than 10 dairy cows. These milk-sheds are often linked to the previous existence of an old state farm from the collectivist era. An effort was made to provide small producers access to land.

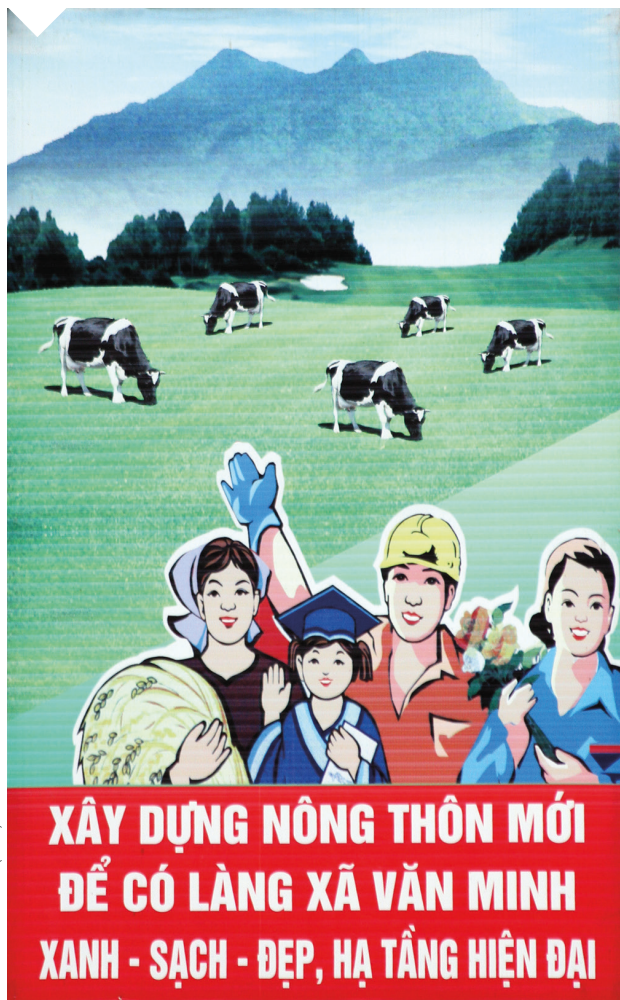
## Space and market problems

However, these production basins are constrained by land, as agricultural land is in short supply. To increase the quantities of milk collected, dairy companies must either increase the number of dairy farmers supplying them, or promote an increase in the number of cows per hectare and per farm. The first option involves the diversification of farms to dairy farming, which was the driving force for dairy development during the 2000s. The second solution involves intensifying fodder production and turning to regional markets for green and dry fodder, which increases production costs.

## Towards mega-farm models

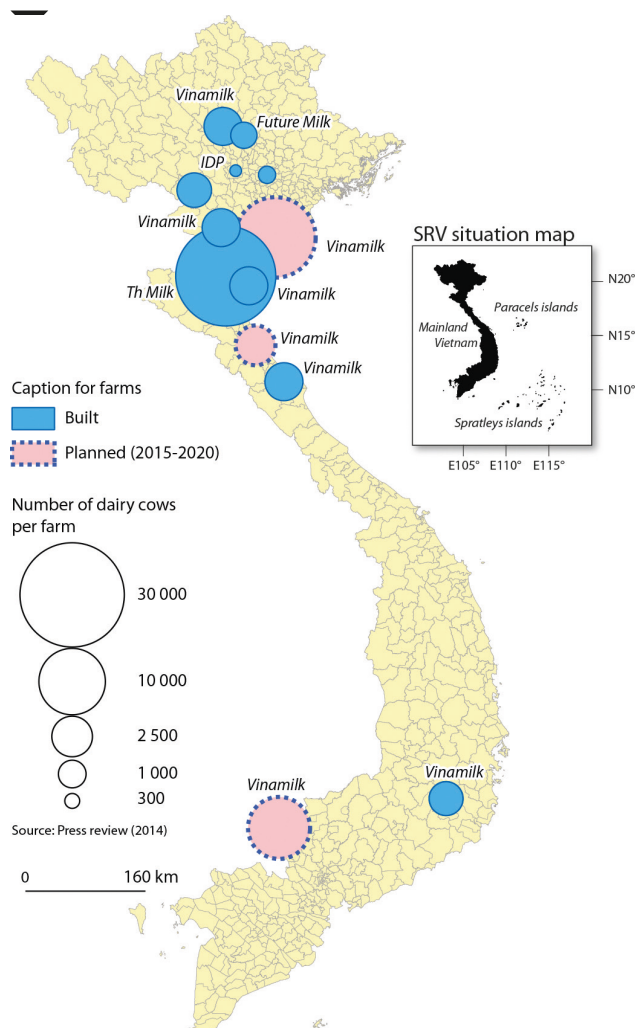
Since the early 2010s, the emergence of very large industrial dairy farms has shaken up dairy production in Vietnam. Between 2011 and 2015, the dairy cow herd doubled, from 120,000 heads to 250,000. Yet the mega-farm model of 500+ cows is not something new. Vietnam indeed experimented with the establishment of very large state farms during the collectivist period.

Poster of dairy production Mont Ba Vi



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Large dairy farms operating in 2014 and projected by 2020



## Mega-farms on the remnants of collectivization

These farms have several hundred dairy cows. Moreover, most recently established mega-farms were set up on the land of former state farms. This is the case of the IDP experimental farm in Ba Vì and the TH Milk mega-farm, which had 44,000 dairy cows in 2015. In 2014, we drew up a list of all the intensive farms officially present in the country. We counted eight farms with over 1,000 cows, of which one had a total official herd of 40,000 dairy cows. Dairy companies such as VinaMilk, TH Milk, and FrieslandCampina currently hold 25% of the national herd on these “mega-farms”.

## Clashing production models

Are these new livestock production models peacefully existing alongside family farms? Or is there a clash between the models? The question seems to be clear for the TH Milk company, which announced that it wants to alone produce 50% of the milk consumed in the country. In 2015, the company already produced 17% of the national output. Moreover, the current orientation of public policies indicate that the government seems to support these gigantic models.

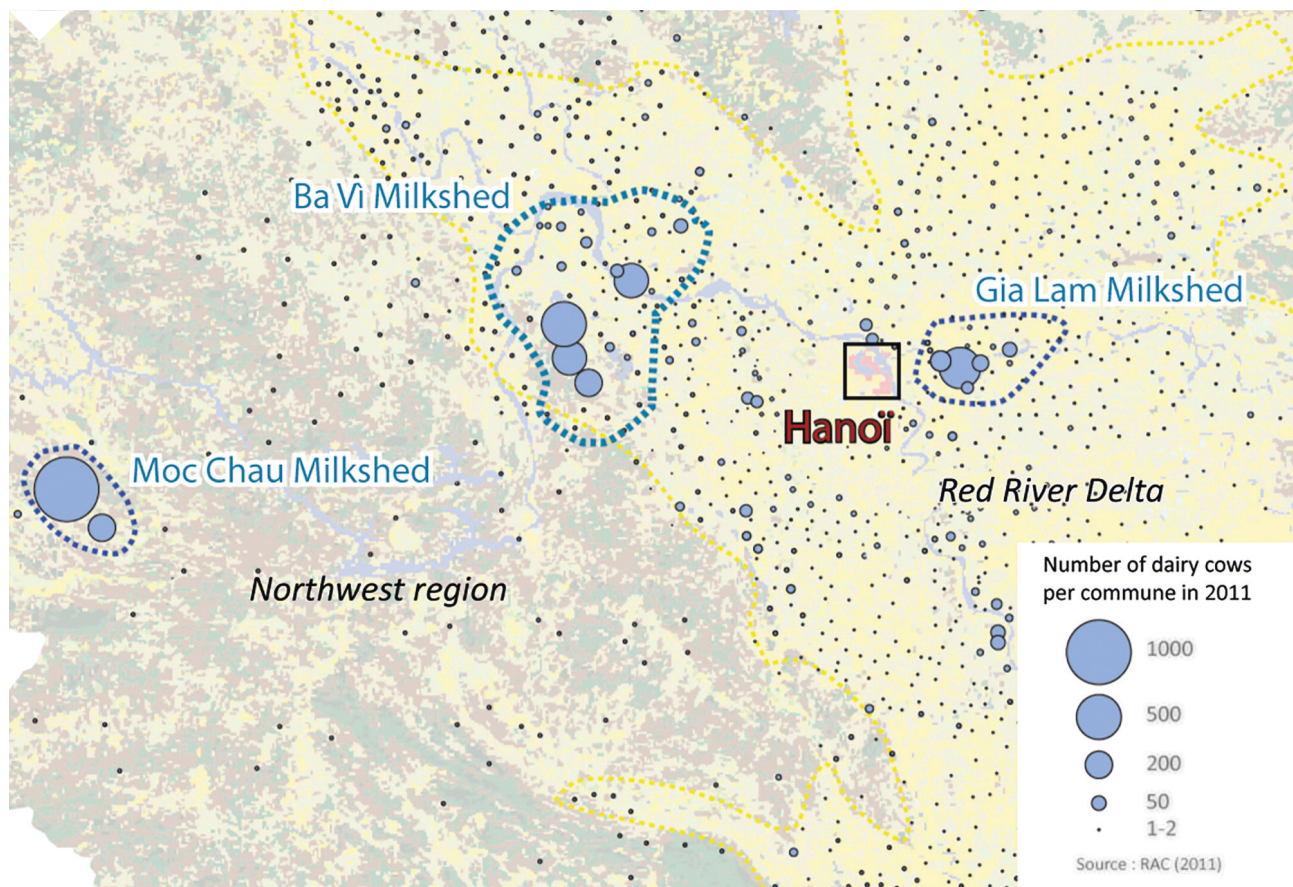
## Mirrored in geography

These farms are mostly located in the north, where state farms are the most numerous, but also where family farm dairy production is the lowest. These mega-farms have rapidly enabled the country to sharply reduce its dependency on imports. So the question may be: is there competition or synergy?



## In the north: from state farms to family farms

*Dairy production around Hanoi in 2011*



### The milk-sheds of northern Vietnam

In the north of the country, the agricultural census of 2011 reported 25,000 dairy cows. They were mainly distributed in three large milk-sheds: Mộc Châu, Ba Vi and Gia Lâm. The province of Nam Định also has seen its herd increase in recent years. The location of these livestock is not accidental. It is related to the location of old dairy farms. Gia Lâm is a former concession established by a rich Vietnamese back in the 1940s, while Ba Vi is related to a colonial concession held by a Frenchman who made a fortune growing coffee. After independence, these two farms were occupied by the army, then were nationalized and turned into state farms. Mộc Châu has a slightly different profile because this farm has no colonial history, and was built entirely by the collectivist regime. Proud of its communist management, the Mộc Châu dairy farm (named “Red Star” in the beginning) was then gradually privatized.

### Lowlands and highlands: different trajectories

During the 1990s, the government wished to develop small family dairy farms. Communes in the Red River Delta were chosen to host this new production. The large milk-sheds were politically and financially supported, but small production units emerged locally in the plains. In contrast, production in the mountains remains limited to the area around Mộc Châu farm.

*Harvesting elephant grass in Ba Vi*



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## Family farms and mixed farming systems

Dairy farms have on average 0.4 hectares (or about 10 *sào*). All of the farms devote 720 to 1000 m<sup>2</sup> of forage land per dairy cow. This represents a density of 10 to 14 dairy cows per hectare. These farms also use about 0.4 kg of industrial feed concentrates per litre of milk. The study of the diversity of dairy systems shows that these are above all diversified farming systems. Farmers grow elephant grass for the dairy unit, as well as rice, maize, tea, and fruit, they may even raise pigs and chickens, and in some cases also engage in an aquaculture activity. All on less than half a hectare on average.

## Gradual specialization

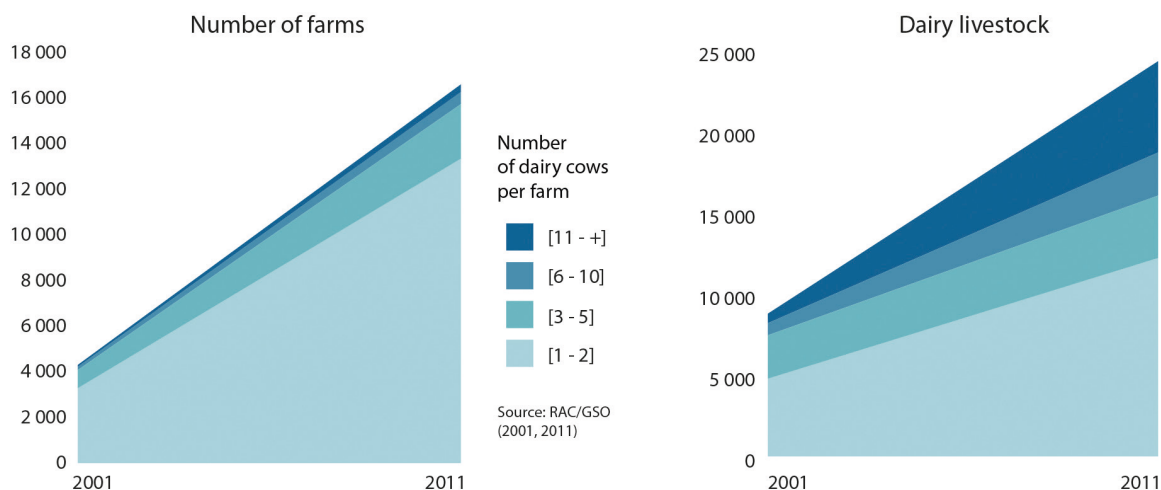
In the main production basins, larger farms are emerging. They are specializing in dairy production by restructuring land use towards the production of elephant grass, maize between seasons, and sometimes legumes for the nitrogen input. These farms are confronting a problem of space because it is difficult to find land to rent or purchase. They therefore buy fodder on local markets. Their size varies between 10 to 50 cows per farm.

Dairy production around Ba Vi in 2011



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Evolution of the number of dairy farms and of the dairy herd between 2001 and 2011 in northern Vietnam



## The location of industrial actors

The geography of industrial actors in the north of the country is not at all haphazard. The Mộc Châu state farm became a private company in the 1990s, but the State remained a shareholder until 2017. No other company can collect within the perimeter of the former farm. In Ba Vi, the situation is slightly different. In 2012, district authorities signed a partnership agreement with the DP company for milk collection in the district. Small local processors are tolerated as the Bavi milk company is located next to the Ba Vi research center, a former state farm that has been reconverted into a forage research center. Lastly, the Gia Lâm zone is more open to competition between Vinamilk, IDP and other foreign companies such as Dutch Lady and Friendscampina.

## Towards medium-size commercial farms?

Due to the political difficulties of collecting milk from small farmers, companies are investing in intensive commercial farms. Although they remain limited in number, these medium-size farms are providing a reliable supply of milk to firms within an unsteady regulatory context. Milk production remains a State concern that is subject to political and economic uncertainty. Large farms are consequently a secure source of milk.

Dairy cows near Hanoi in 2011

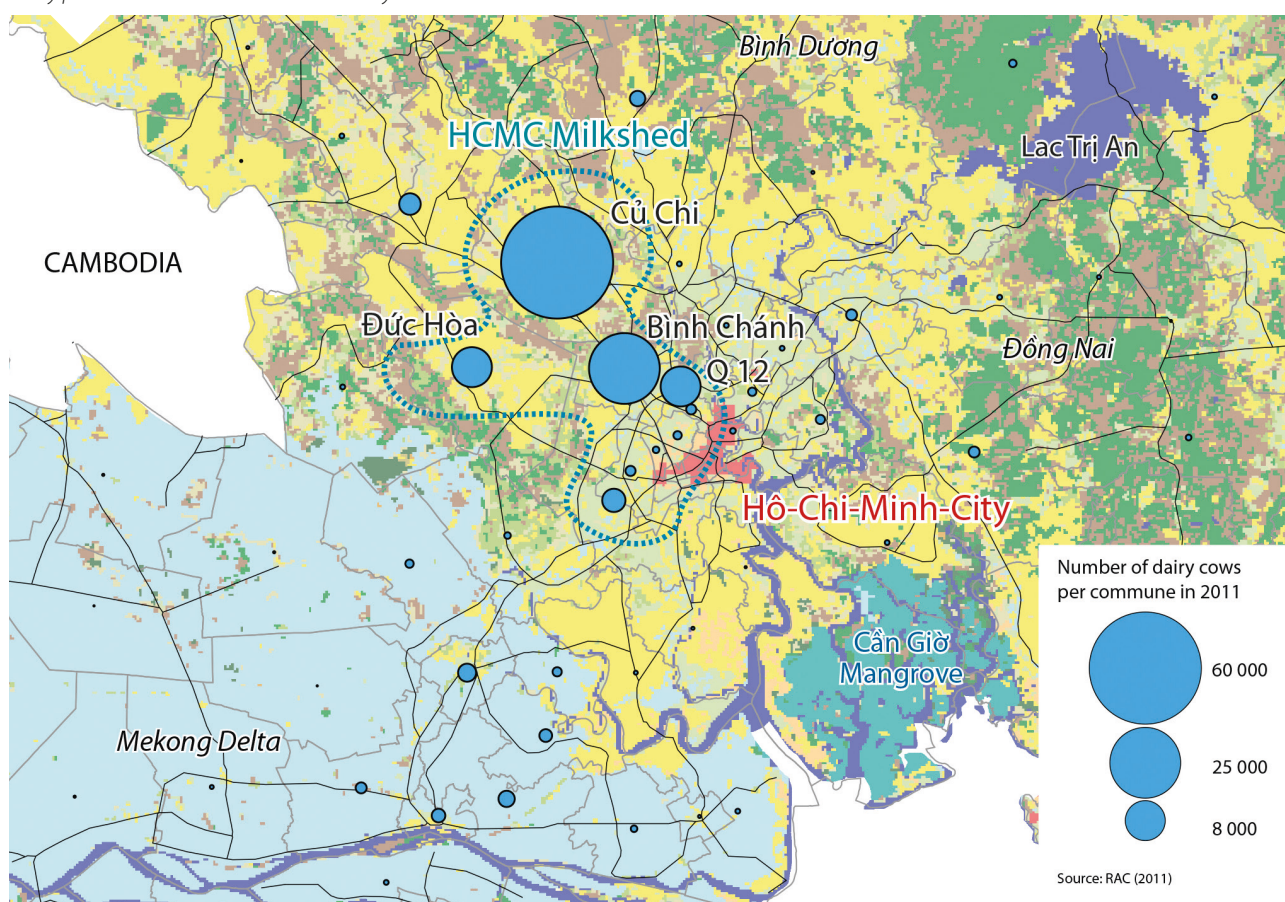


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## In the south: from family farms to company farms

Dairy production around Ho Chi Minh City in 2011



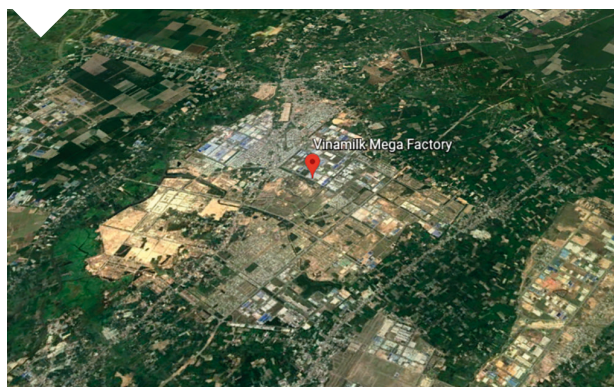
### An inherited milk-shed

The creation of the Ho Chi Minh City milk-shed has a long history. In the 19th century, Tamil, Pathan and Sikh communities already were producing milk on the outskirts of the city along the riverside in the Camp des Mares, between the city center and Chợ Lớn. In 1959, the Australian government set up a dairy farm in the military zone south of Bến Cát. This military zone was a former colonial rubber concession. Two hundred cows and 10 bulls were sent by boat in 1959 and by plane in 1972 under an agriculture cooperation agreement. The first family dairy farms in the region appeared in 1989. In the 2001 agricultural census, the authorities counted 7,000 farms with a total of 35,000 cows in the Ho Chi Minh City area, which represented 79% of the national herd. In 2011, the number of cattle exceeded 80,000 heads, or 58% of the national herd.

### Peri-urban livestock farming

In the 2000s, the dairy sector was growing rapidly. The number of livestock doubled in the space of 10 years. Growth was slower than in other regions of the country, but still represented the largest increase in the number of cows in the country. Reports by international experts mention a risk of development in a context of urban sprawl. Livestock farms in District 12 were clearly the first affected by the city's growth. However, in the district of Củ Chi (northwest of the city), the State controls a significant amount of land, limiting the development of the city without the consent of the provincial authorities. The pressure on land therefore is strong and limits the development of farms outside former state farms.

Vinamilk factory in Mỹ Phước, Bến Cát, Bình Dương



A milk tank in front of a collection point in Củ Chi



© B. Faye (2000)



Dairy production around Ho Chi Minh City in 2011

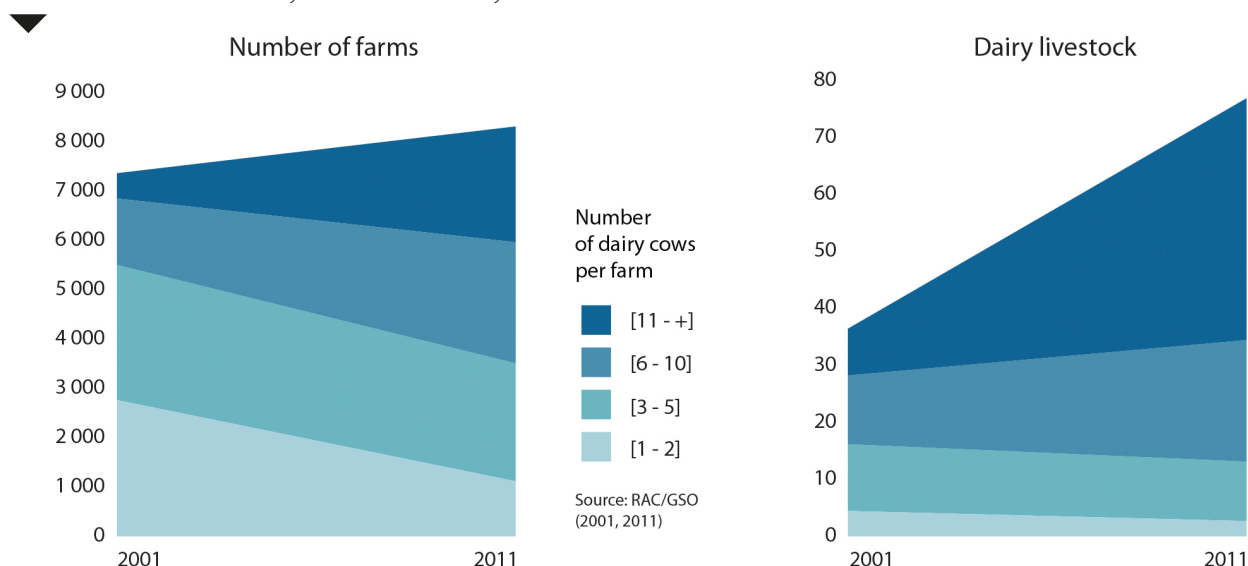


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## The district of Củ Chi at the center of the system

In 2015, Củ Chi had nearly 60,000 dairy cows. Farms with more than 200 dairy cows have multiplied since 2010. Around 16,000 families are directly involved in dairy cattle farming. According to official estimates of the National Institute of Animal Sciences (NIAS), a farm with 10 dairy cows can generate a turnover of US\$30,000, or US\$7,500 per hectare. This turnover is five times higher than a rice crop. The district decided to transform 18,000 hectares of rice paddies into fields of elephant grass to supply dairy farms in the surrounding area. In total, the productivity of Củ Chi dairy cows exceeds on average 15 litres per day over one cycle. In 2000, the average productivity was 8 litres per day over one cycle. Productivity has therefore clearly increased in this region. The modernization of farms and the professionalization of farmers are contributing greatly to this improved efficiency. Furthermore, the restructuring of the herd in this part of Vietnam is the most advanced.

Evolution of the number of dairy farms and of the dairy herd between 2001 and 2011 in southern Vietnam



## Restructuring production

While across the country, farms have an average of 4 dairy cows, Củ Chi farms have an average of 8 cows. Half of the farms have more than 6 cows. Restructuring is currently on an upswing as the number of farms continues to increase. These farms represent 80% of the herd in the district. Production is therefore concentrated on a limited number of farms, which is more interesting for dairy manufacturers.

## Competition for control of the district

The district of Củ Chi is at the center of a major battle between industrial players. On one side, the incumbent operator Vinamilk is trying to maintain its position and discourage other processors from coming to collect milk in the region. However, its hegemony has been eroding for some time. For example, FrieslandCampina, which markets the brand Dutch Lady, established itself through funding for development and production support. These two companies then provided outreach training to other farmers on pilot farms. These two companies won the right to collect in the zone. The IDP company (north Vietnam) tried to establish itself in the region but the attempt was unsuccessful. This failure compromised investments made by the company in northern Vietnam.

## 2016, a breakdown in the market

According to information released by local authorities, 2016 was a very bad year for dairy production in Vietnam and in Củ Chi. Until 2015, the price paid to the producer was at 12-14,000 VND (US\$0.5-0.7) per liter of fresh milk. In 2016, companies like Vinamilk started putting huge pressure on farms by refusing to buy milk from thousands of farms. In Củ Chi, nearly 800 farmers suddenly found themselves without access to any sales outlet. At the national level, the priority of dairy manufacturers is to buy powdered milk that is sold on the market at between VND 7,000 and 9,000 (US\$0.3) a kilo.

## Bewildered small farmers

This milk collection price crisis occurred while the market was booming. After generating revenue for numerous small farmers in the region for many years, the current collection system favors commercial farms with several dozen or even hundreds of cows. Some smallholders are organizing into cooperatives in order to secure outlets for their milk. The growth of cooperatives is not always supported by the manufacturers. In some cases, the cooperatives are supported by development projects or NGOs, as, for example, in Củ Chi.

## In the centre: going gigantic through technology

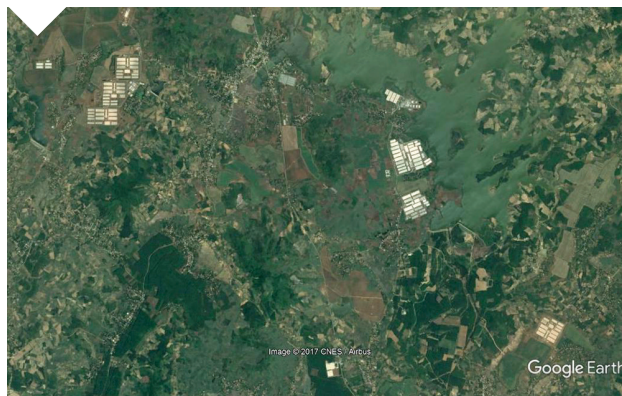
### A closer look at TH

The dairy farm run by the TH Milk group is one of the largest farms in the world in terms of the number of animals on a single site. In June 2015, the farm officially had 44,000 dairy cows, including 22,000 cows in lactation. The complex is located in the province of Nghệ An, 250 km outside Hanoi. The farm is built on two communes in the district of Nghĩa Đàn: Nghĩa Sơn and Nghĩa Hội. The closest town is Thái Hòa, about 10 km away. The exact position of the site is 19°24' N, 105°26' E. This new type of farm was set up in cooperation between the governments of Vietnam and Israel.

### Organized into clusters

The farm is managed through a pyramid system of farms (*trại*) organized into clusters (*cum*). Cluster 1 is composed of three farms (n°1, 2 and 3); Cluster 2 also includes three farms (n°4, 5 and 6) and a quarantine farm (n°7). Two other clusters were under construction in 2015: Cluster 3 with two farms (n°8 and 9) and Cluster 4 with three farms (n°10, 11 and 12). The images available on Google Earth from CNES / Astrium in May 2013 provide precise details on the agricultural infrastructure. Two clusters of farms have already been built. The facilities of the industrial holding extend over 162 ha.

Location of TH Milk clusters



Satellite view of Cluster 2



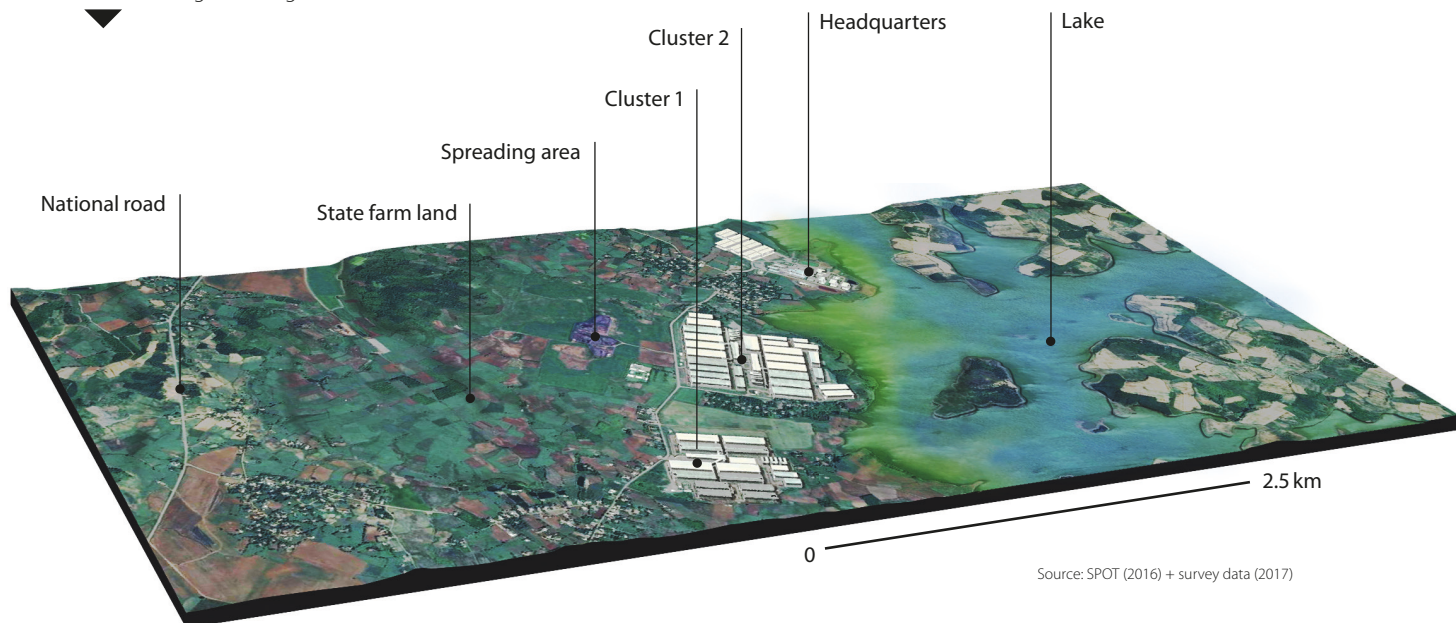
### How many animals are there really?

The importation of dairy cows from Australia, New Zealand, Canada and the United States, which began in 2009 and was suspended in 2012, was reported extensively by the press. The animals were 100% Holstein-Friesian (HF) cows. In November 2013, the project's first herd was composed of 13,450 cows and 12,800 heifers. According to De Heus, the TH farm had 31,000 dairy cows in May 2014. The number of animals raised on the TH farm was officially 44,000 dairy cows in 2015. This number was increasing.

### Ambitious production goals

According to Vietnamese newspapers, at the beginning of the project the farm aimed to produce 200,000 tons per year. According to Afimilk, the company processed 300 tons per day (109,500 tons per year) in 2012 and reached 500 tons per day in 2015 (182,500 tons per year). In June 2015, according to Mr Tấn, the director of milk processing, production was 450 tons/day and could reach 500 tons/day in winter, which met the company's objectives.

3D modelling of the organization of Clusters 1 and 2





## The difficult question of feed

Feed management relies on a Total Mix Ration (TMR) approach using computer software. The ration is based on mixing: i) a silage-based forage ration; ii) a concentrated industrial feed; and iii) other supplements such as salts and nutrients. The silage mix is based on different kinds of fodder: maize, Mombasa guinea grass (*Panicum maximum*), and other imported raw materials such as Alpha-alpha dry hay and soybeans. In 2015, fodder requirements were estimated to be 850 to 1000 tons per day or 31,0250 to 36,5000 tons per year. Each of the 44,000 cows needs about 7 tons of fodder per year, or 20 kg/day. The farm also produces sunflower and peas. Industrial concentrates are supplied by four international food companies. The land on which the cattle feed is produced is part of a former state farm that has now become a cooperative and is still owned by MARD.

Workers on a TH farm



© TH Milk (2015)

Cluster 2 seen from the sky



© TH Milk (2015)

## Effluent management, a subject of debate

The solid part of the manure is managed in the barn as “deep layers” of litter. These layers are composed of straw and crop residues. They are a good fertilizer and are sold to nearby rubber and coffee plantations. In principle, the liquid part of the effluents is treated in industrial plants. Water is treated in three stages: sedimentation, filtration and chlorine treatment. Treated water is discharged into the nearby lake. The treatment capacity is 500 m<sup>3</sup>/day, which seems quite insufficient. According to some newspapers, the risk of pollution in neighboring areas is very high. About 600 households were affected by the pollution of rivers and underground drilling. These families were relocated to other villages.

Pollution and displacement of communities



© Vietnam News (2015)

## A technological farm

The Afimilk company provided the herd management tools. They are based on an individual recording schedule using AfiFarm software. Each cow is equipped with an electronic chip and a leg sensor to monitor its activity. The electronic chip can record the quantity of milk produced at each milking, and the microbiological quality of the milk measured by electrical conductivity. Farm staff is mainly composed of Israeli engineers from Afimilk who are responsible for managing the farm. About 100 Vietnamese make up the workforce. The company tries to promote social welfare by employing local people. However, the impact on employment is very limited and falls far short of the goals announced at the start.

## TH's marketing campaign

To fully understand the merits of this mega-farm in relation to the debate on agriculture production models, the TH company's marketing techniques should be considered. The company is proud to present the farm's modern features, which are a selling point for consumers. Cattle are shown in clean barns with quality feed and an international team dedicated to animal care. For many Vietnamese consumers, milk from the mega-farm is “safe” and the quality is superior to other brands supplied by small family farms. In the main cities of the country, the company has opened shops devoted to the sale of TH milk. These shops are copying the design of a famous electronics brand to sell milk as a technological product, which is what milk is in Vietnam.



## What is the future for milk-sheds?

### The “local” image confronting mega-farms?

Faced with the development of mega-farms, can a network of dynamic family farms be maintained within the milk production basins? To a certain extent, the answer may be found in the field. Indeed, Mộc Châu, Ba Vì, Gia Lâm, Đà Lạt and Củ Chi are all names of districts which are well known and respected by Vietnamese households. Consumer know that these regions produce milk and identify products with their names. They often associate mountain landscapes with pastures and dairy production. However, to firmly establish the development of dynamic milk-sheds, producing milk is not enough. These milk-sheds need to develop emblematic products. Ba Vì has a long tradition of milk candy while Mộc Châu was the first to supply Hanoi with cheese (Mộc Châu tomme cheese). For a number of years, a goat cheese farm has been operating in Ba Vì. A Japanese entrepreneur is producing mozzarella and camembert from Đà Lạt cow milk. These products can enable a diversification of markets outlets and anchor dairy production to a local setting, which could be called “territorialisation”.

*Tasting yoghurt in the Ba Vì dairy*



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*Ba Vì mountain as a dairy landscape*



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### Territorialisation: risks and opportunities

The local anchoring of production and the development of brands or geographical indications is not without risk for manufacturers. The history of the IDP company in Ba Vì illustrates these difficulties. After signing a partnership agreement with the district of Ba Vì, the company sought to develop a certified brand, “Ba Vì milk”. But to expand its collection area, the company then sought to develop other more generic brands. In the south of the country, during the milk price crisis of 2016, the district of Củ Chi wanted to develop its own product brand. However, the district’s identity was not sufficiently distinct to be able to support the development of a label or a geographical indication. Nonetheless, consumers are looking for quality, and even organic products. These experiences demonstrate the importance of the role of local authorities and industrial firms. It is clear that the future of milk-sheds in Vietnam lies in a collaboration between the State, companies, and farmers.

*Tasting cheese in the Ba Vì research centre*



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# Chapter 6

## Perspectives: in favor of sustainable livestock production pathways

*G. Duteurtre, Nguyen Mai Huong, J.-D. Cesaro, B. Dorin, B. Hubert, Hoang Vu Quang*



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*Mountain pigs in a H'Mong village*



# Crop-livestock integration in response to intensification

## A fresh look at livestock system dynamics

The pathway of rapid intensification of livestock systems in Vietnam drove farmers to specialize their production units. The “decoupling” of livestock farming and crop farming took place gradually over recent years.

### Before 2000

On farms, the cultivation of intensive crops like rice was closely integrated with the production of livestock such as pigs. In these integrated systems, livestock production played a key role in the transfer of fertility between natural areas (producers of biomass), cultivated fields (receivers of livestock effluents and suppliers of crop residues) and fishponds (also making use of the effluents). These recycling mechanisms also were promoted by the VAC model associating gardens (*vườn*), ponds (*ao*) and barns (*chuồng*) (see Chapter 4).

### After 2000

The rapid increase in the number of commercial farms specialized in livestock and the intensification of more traditional livestock systems resulted in the decoupling of the different production units on farms. For economic reasons, the management of organic matter became a secondary concern for the “livestock farmers”. These developments were facilitated by the use of chemical fertilizers and high-yielding crop varieties. However, the rapid growth of intensive landless pig and poultry farms ran up against the absence of facilities to process livestock effluents. Some farmers started to organize themselves to recover and dispose of the effluents free of charge or at low cost, but the abundance of fertilizer put some territories at an increased risk of pollution.

## The institutional response

Government services have responded by promoting spatial segregation policies for livestock farms. MARD’s strategy of creating “livestock concentration zones” (*khu chăn nuôi tập trung*), which was launched in 2008, recommended that areas be set aside in each district for the establishment of commercial farms. These livestock concentration zones were a powerful tool to encourage the relocation of production. However, instead of solving the problem of effluent management, these livestock zones have amplified the concentration of animals.

*A biogas plant on a pig farm*



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In a context of climate change and the industrialization of agricultural production, it would be worth considering the development of a livestock model that is more local and resilient to coming changes. Several solutions are recommended:

### At the farm level

#### *Build a biogas production unit:*

With the methanization of effluents, farmers can produce a gas useful for cooking and heating. Biogas systems are often under-sized due to limited land. The tanks fill rapidly and the system releases the surplus into the environment. Many produce more gas than needed. Few produce electricity with it. The burned energy of gas is lost.

#### *Develop fish ponds*

The creation of fish ponds where effluents are used to feed fish is a technical solution that is fairly easy to implement but requires space and, preferably, impervious soil. The regions with hydro-morphic soil are favored. Ponds can easily accept 300kg of organic nitrogen per hectare. However, if the livestock systems produce more than this quantity, the agro-biological functions can no longer be maintained.

### At the territory level

#### *Phytopurification:*

Ponds and pools around farms recover surplus effluent. These areas also are used to cultivate crops for animal feed. Aquatic and aquaphile plants may be found in them that reactivate using in particular the nitrogen contained in organic matter. This type of treatment is a good way to manage biogeochemical flows but cannot deal well with increased loads. Furthermore, this technique only works in hydrophilic environments.

#### *The reuse of effluents in agriculture:*

This traditional practice remains completely relevant today, but it must be considered at the scale of the territory and not only at the level of individual farms. Full-fledged markets must be established to enhance the complementarities between livestock farms and crop farms. At the same time, the price of chemical fertilizers needs to be raised and support services should encourage farmers to market effluents. Numerous crops such as fruit trees and horticultural crops respond well to organic nutrients of animal origin.

### At the transregional level

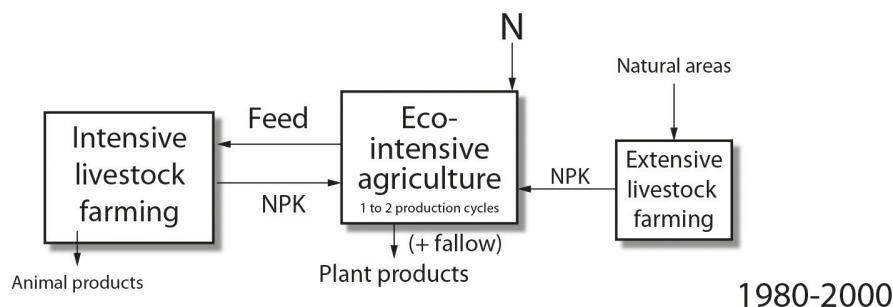
#### *Regional effluent market:*

In certain intensive livestock production regions, some actors are specializing in the collection, transport and resale of animal effluents. Farmers are unable to manage surpluses and government authorities are offering farm-level solutions. These actors therefore are starting to buy the effluents at a relatively attractive price and gather the materials along the main roads. Larger carriers transport these materials to other regions. Composting is fairly undeveloped and there is a lack of treatment plants at the territory level. Some regions are beginning to take an interest but face a lack of funding.



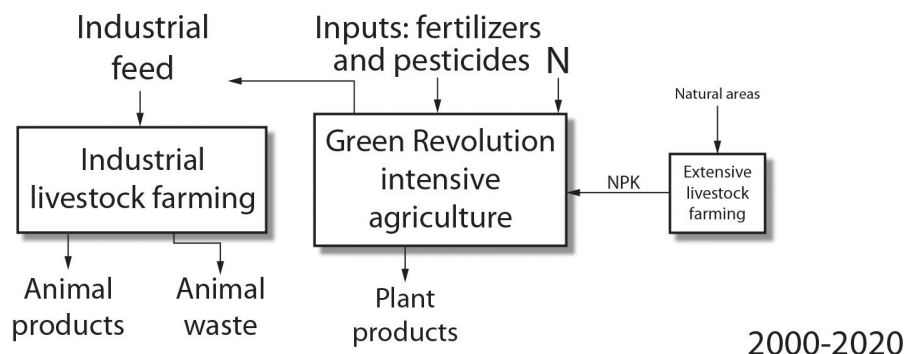
## Integrated model

Farming system 1:  
Internalized nutrient cycle  
with few industrial inputs  
and recycling of organic  
materials of animal origin  
(OA)



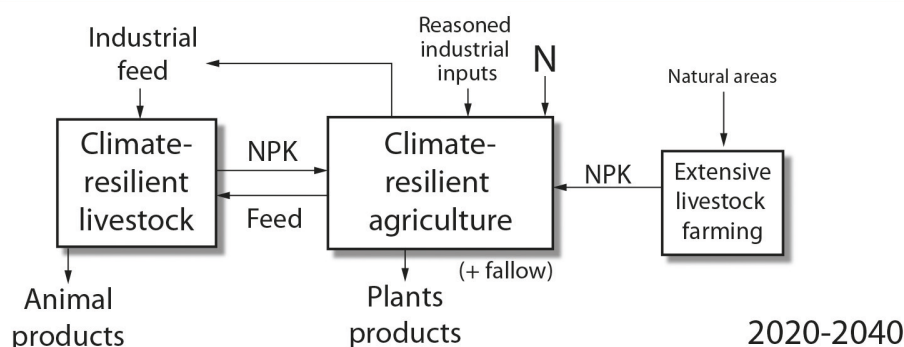
## Specialized model

Farming system 2:  
with industrial inputs,  
decoupling of units  
and limited recycling  
of organic materials



## Localized model

Farming system possible:  
with industrial inputs  
recoupling of units  
with a high level  
of organic material recycling  
Adaptation of food system  
to climate change



### Some recommendations can be made based on current field observations:

- Target the first 100 communes at risk (1% of communes);
- Invest in biogas equipment;
- Invest in producing electricity with energy generated by biogas equipment;
- Plan the location of processing facilities in relation to the livestock production restructuring law;
- Create development permits for commercial farms. All projects with a turnover of over 1 billion VND (US\$40,000) should be subject to authorization in relation to land and production;
- Establish links between commercial farms and companies to treat effluents;
- Encourage and organize export value chains;
- Model the environmental impact of intensive livestock production.

All of these proposals aim to better target government investments in a context where the livestock sector is rapidly transforming, and to promote greater sustainability of intensive systems.

Truck transporting slurry towards Lâm Đồng



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### The issue of health safety

In 2017, a survey of 1000 urban dwellers living in Hanoi and Ho Chi Minh City found that food safety was a leading concern (49% of respondents), well in front of the environment (18%) or corruption (10%). The same survey should be conducted among rural dwellers, who compose two-thirds of the Vietnamese population, before declaring that health safety is the top issue for the Vietnamese. However, it is clear that the urban population is extremely sensitive to this problem. This situation is the result of multiple factors such as cross-border trade with China, the overuse of chemicals in agriculture and livestock, and the massive contamination of consumers. Consumers' concerns do not necessarily translate into radical changes in practice, but they are negatively affecting the government's perception of family farming.

### Traditional versus modern value chains

Competition between traditional and modern value chains encourages agribusiness actors to advertise the quality control measures in the modern sectors. This is the case in the dairy sector, where mega-farms and major processing companies hold a significant share of the milk market, alongside small producers and processors. In the meat and egg sector, sources of supply are also diversified and there are millions of farms involved. The commercial farms are often integrated into agribusinesses. The latter invest in large-scale modern slaughterhouses. This is the case of Vissan, a company that sells meat notably on the markets of Ho Chi Minh City. In the poultry sector, the CP company has basically integrated production with the sale of finished products. The company sells controlled products directly under a registered trademark. However, this way of systematically setting tradition against modernity within production chains and sectors is hiding a more political objective of transforming food systems with industrial players assuming greater control. Particular attention should be paid to the potential emergence of monopolies justifying their concentration strategy solely on the basis of health safety arguments.

### Monopoly or competition, diverse situations

The livestock sectors in the north and south of the country are very different. Around Ho Chi Minh City, the value chains are concentrated around slaughterhouses. Small informal slaughterhouses still exist, but the vast majority of meat consumed in the city comes from the industrial sector. By contrast, around Hanoi, thousands of small and medium-sized country slaughterhouses continue to operate and prosper. Slaughtering is so entrenched in village economies that the transformation of value chains is taking place much more slowly. In the dairy sector, the opposite situation holds. In the north, industries hold strong territorial monopolies. There is usually one industrial dairy per district, while in the south, dairies compete to collect milk.

### VIETGAP standards

Quality standards are established to reassure consumers about the origin of a product. This is notably the case with the Vietnamese Good Agricultural Practices (VIETGAP) standard. VIETGAP is a certification of agricultural practices linked to official regulations. This standard was introduced as part of the agreements with WTO and ASEAN between 2006 and 2008. It is applied to products that have undergone inspection from the farm up to the consumer. However, the certifying bodies only monitor formal channels and ignore 90% of livestock production. Work is being done on voluntary certifications but this requires strong producer and processor organizations.

### Livestock farmer organizations to better integrate largely unknown products

Producer organizations have a long history in Vietnam. For many years, agriculture was collectivized and managed by cooperatives in close collaboration with government authorities. Rather than being an advantage, this recent history has led to the intertwining of private interests and public management in the Vietnamese agricultural sector. Government representatives often have a say, even in the new generation of cooperatives and mass associations. This situation limits private initiative and the development of producer organizations. Yet for the diffusion of good practices, it is essential that private actors be able to organize themselves. Alongside the new generation of cooperatives, informal interest groups sometimes offer themselves as solutions to be promoted.

### Promoting local transformation and the sustainability of sectors

On the one hand, Vietnamese consumers are concerned about health issues, on the other, they are fond of distinctive flavors. Many value chains exist in the country that provide quality foods with specific origins. Black pig meat, smoked mountain sausage, dried beef, artisanal yogurts, mountain cheeses... these are all products with distinctive characteristics that are part of a territorialized approach. It would be wrong to consider the Vietnamese food market as a homogenous whole made of raw products. A taste for originality and authenticity is extremely developed in what remains a rural society. In addition, urban consumers are also demanding quality products but are not always sure of their origin. Culinary tourism is an interesting niche sector even for livestock products, especially in highland regions.

Transporting a pig to Hanoi



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## Đồng Nai livestock and food security project



### Based on current field observations, some recommendations can be made:

- Promote the organization of actors: associations, farmers' cooperatives, interest groups;
- Promote contracts between industries and local governments: prepare local development plans by sector, but also plans for investments in infrastructure and human development (PPP);
- Establish more transparent price and profit monitoring mechanisms at observatories directed by the statistical services in coordination with producer organizations and industries;
- Promote quality local products: identify products of animal origin recognized by consumers as having specific qualities and promote product specifications to enable their defence and improvement;
- Facilitate links between companies and producers: create a long-term partnership between livestock producers and industry based on support for agricultural production (credit, training, extension, techniques).

A milk collection center in Ba Vì





# What are the foresight scenarios for the dairy sector in 2030?

## Developing scenarios of the dairy sector's future

Under the framework of the Revalter project (information on the project is presented in the introduction of this atlas), a multi-disciplinary research team led participatory foresight workshops to explore feasible options for developing dairy production in Vietnam. The approach was based on considering different levels of analysis (farm, sector, districts, country). In the context of local and national workshops with industry stakeholders, the research team presented three possible but contrasting scenarios. These scenarios were described qualitatively (as storylines) and quantitatively using FAO projections to 2030.

## Starting point of the scenarios

Strong population growth and increasing urbanization is putting food markets under heavy pressure. Rising per capita incomes are strengthening demand for diets high in protein and animal products, including dairy products. The country is becoming more and more deeply integrated into global economies and is facing fierce competition from imported animal products.

### “Mega-farm – maximum concentration” scenario

Vietnamese milk production is shouldered entirely by a small number of very large, integrated, industrial farms. To establish large-scale farms, local authorities facilitate the transfer of land held by smallholders to private investors. This policy is clearly guided by the desire to promote modern technologies and large, capital-intensive farms where production costs are reduced through economies of scale. This mass production orientation generates environmental impacts related to high local concentrations of liquid waste and to increased imports of raw materials (maize, soybeans, etc.) produced abroad. The social impacts are also very problematic in this scenario, with thousands of agricultural workers removed from their land and deprived of their agricultural livelihoods.

### “For a social and inclusive sector” scenario

Milk is produced only by family farms. The government supports small dairy producers to become competitive professional farms under the framework of long-term development programs. These national policies are adapted to each local situation. Small farmers engage in milk production through contracts with milk processing industries. Government support services encourage each farm to achieve forage autonomy and develop the capacity to treat effluents. Farmers get good economic returns from their integrated livestock-crop farming activities. The local environment is green and healthy, and many locations develop their own geographical indication for dairy products. This scenario estimates the number of jobs created in production at 116,000, which is 7.1 times higher than the “mega-farms” scenario.

### “Dual system” scenario

Vietnam engages in a rapid transformation towards a modern, green and inclusive economy. A dual agriculture production system develops. Small and medium-sized farms play an important role in local ecosystems; and large intensive farms are strongly integrated into global supply chains.

*Foresight meeting on the dairy sector in Hanoi*



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*Foresight meeting on the pig sector in Sơn La*



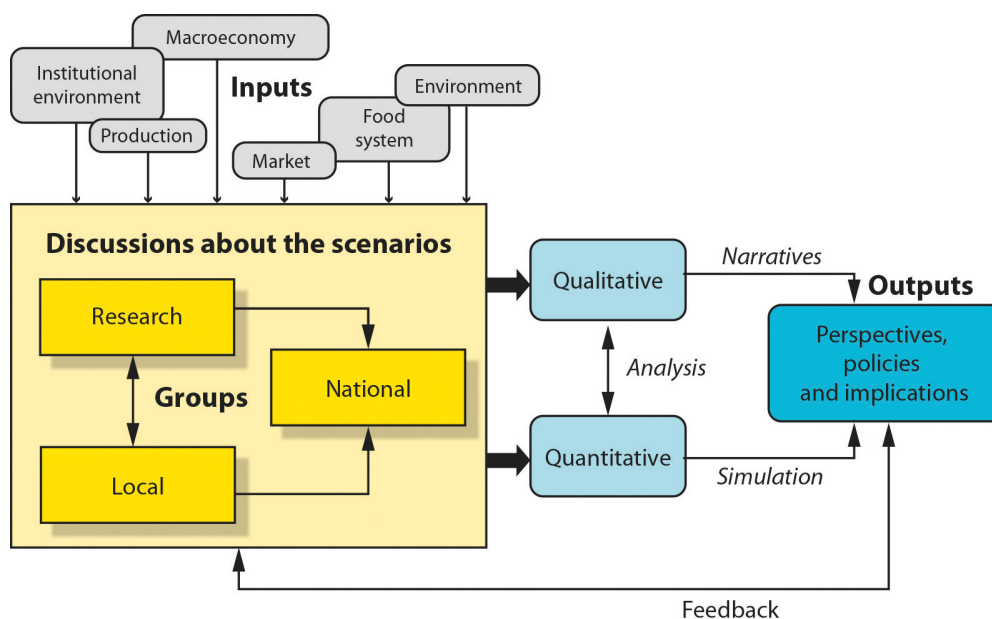
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*Foresight meeting on the pig sector in Đồng Nai*



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## Policy implications

These three scenarios are not predictions. They are meant to help anticipate what the future could hold, and to consider how to engage in different development pathways. The role of public policies is highlighted in particular.

## Coexistence and cohabitation of agriculture models

The comparison of the three scenarios emphasizes the importance of promoting the coexistence of different agricultural models. As different types of farms have different impacts, their roles in sustainable development sectors seem to be complementary. The development of large farms renders it possible in the short term to balance supply and demand. However, this is accompanied by major social and environmental risks. In contrast, the growth of smallholder production makes it possible to adapt to local land constraints, provide work in rural areas and preserve the environment.

## Support the transition towards a market economy

The dual system scenario is already emerging in Vietnam. The main role of family farming seems to be not only supporting rural livelihoods, but also producing local foods and cultural values, and maintaining rural ecosystems. However, small farms will have to diversify their activities, change their production practices and invest in economies of scale through new organizations (including group farming) and innovative technologies. For this, considerable investments in technological innovations will be necessary, with appropriate public credit systems and support. These investments will lead to more resource-intensive and labor-intensive farming systems.

## Integrate economic, social, and environmental efforts in the development of livestock production

Policymakers need to consider not only economic dimensions but also labor, land ownership, food and environment indicators to promote a sustainable future for dairy production in Vietnam. Local and national governments must continue to support mega-farms and intermediary companies, but also family farming.

Scenario outputs in 2030

| Scenario                               | S1. Mega-farms maximum concentration | S2. For a social and inclusive sector | S3. Dual system |
|--|--------------------------------------|---------------------------------------|-----------------|
| National production                    | 700 000 tons                         | 700 000 tons                          | 700 000 tons    |
| Number of dairy farms                  | 79 MF                                | 23 330 EF                             | 39 MF 12 200 EF |
| Jobs created in the agriculture sector | 15 500 jobs                          | 116 000 jobs                          | 67 000 jobs     |

National foresight meeting on the dairy sector



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# Conclusion

## Major changes, past and future

Livestock production in Vietnam is being fundamentally reconfigured. Rarely in history has an agrarian transformation been so rapid. These developments are affecting the pig farming, poultry farming, dairy farming and cattle fattening sectors. We are witnessing the emergence of agro-industries up and down value chains, the transformation of family farms, and the emergence of new types of industrial farms. Among the factors favoring this “livestock revolution” are a quantitative increase in demand, the opening up of regional and international trade, and the emergence of standardized industrial technologies. These overall trends are fostering the belief that a “new” form of livestock production is emerging that is assuming a uniform shape across the country.

## The diversity of development pathways

However, these changes are not uniform. To the contrary, the mapping of the transition of Vietnamese livestock production shows a tremendous diversity of development pathways. This diversity is the key lesson of this Atlas. Between the dynamics of pig farming observed in Thống Nhất district, the growth of smallholder dairy production in the Ba Vì basin, and the production of black pigs in the Northwestern mountains, the contrasts are striking. Highly intensive forms of livestock farming are emerging in peri-urban areas, while more extensive

and integrated farming systems continue to prevail in more isolated rural areas. Similarly, while some regions are engaging in production specialization dynamics, other territories remain highly diversified. Local natural resource endowments, the organization of space, local social organizations, actors’ networks, local industrial strategies, and local variations in public policies are the factors explaining the critical importance of “local” with regard to “global”. Consequently, the transformation of livestock production must be grasped at the local level. One must understand the differentiated roles of livestock in the sustainable development of territories.

## Outstanding policy issues

These transformations indeed have a significant impact on local communities. Consequently, this livestock revolution is a cause for concern. The emergence of increasingly industrialized production also challenges national development policies as well as local development pathways. In particular, this Atlas highlights the risks associated with land concentration policies and the emergence of corporate capitalism. More than ever, employment and rural populations must be placed at the heart of regional development policies, fostering win-win partnerships between companies and family farms and encouraging complementarity between livestock and crop activities for the sustainable management of ecosystems.

## Coordinators

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Geographer-cartographer with the joint research unit (UMR) SELMET/CIRAD  
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## Acronyms

ANR: French National Research Agency

CASRAD: Center for Agrarian Systems Research and Development (Vietnam)

CIRAD: French Agricultural Research Centre for International Development

CNRS: French National Centre for Scientific Research

FAO: United Nations Food and Agriculture Organisation

GREASE (Platform in partnership): Management of Emerging Risks in Southeast Asia

IFPRI: International Food Policy Research Institute

INRA: French National Institute for Agricultural Research

ILRI: International Livestock Research Institute

IPSARD: Institute of Policy and Strategy for Agriculture and Rural Development

LIFSAP: Livestock Competitiveness and Food Safety Project

MALICA (Platform in partnership): Markets and agricultural linkages for cities in Asia

NIAS: National Institute of Animal Sciences (Vietnam)

NIVR: National Institute of Veterinary Research (Vietnam)

PRISE (ex-Platform in partnership): Intensification of Livestock Systems Research Cluster

RUDEC: Rural Development Centre (Vietnam)

VASI: Vietnamese Agricultural Sciences Institute

VNUA: Vietnam National University of Agriculture



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## Revalter project team at the final workshop





The Atlas of Livestock Transitions in Vietnam (1986-2016) is a synthesis of a five years research project. It combines results from several fieldworks together with a systematic spatial analysis of the 4 agricultural censuses conducted from 1994 to 2011. With nearly one hundred maps and graphs, the Atlas presents facts and data on the process of gradual industrialization of a sector that remains largely based on small-scale farming. The rapid development of livestock production in Vietnam is responding to market demands and regional specializations. Investment in the sector is concentrated around the outskirts of large cities, where a rapidly growing number of modern farms are copying a globalized industrial farm model. However, 'industrial' does not necessarily mean 'landless' because livestock manure is largely reintegrated with crop production. Outside regions connected to international and urban markets, smallholder livestock farming is being transformed through a gradual decline in the number of producers. High population densities are nonetheless posing limits on average farm size. Livestock farmers are adopting new technologies and practices to reduce their environmental impacts while enabling intensive production near residential areas. This atlas presents this diversity of transitions that are specific to an emerging sector. It represents a useful tool for anyone engaged in supporting sustainable agricultural development in countries of the Global South.

